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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

January, 1975

Vol. 18, No. 1

Pheasant Populations and Land Use

Mr. G. Blair Joselyn, leader of this project for the past several years and employed on it since 16 April 1962, resigned 15 January 1975 to accept a position as Wildlife Research Supervisor, Section of Wildlife Research, Minnesota Department of Natural Resources. Blair's resignation leaves a large void in Illinois, but we wish him well in his new position.

Until there is a decision by the Illinois Department of Conservation regarding the future of this project, reports from it will not appear in the Monthly Wildlife Research Letter.--Glen C. Sanderson.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

State-owned forest lands open to public hunting experience considerably more hunting pressures per acre of habitat than comparable forests in private ownership.

We have been collecting data on hunting pressure and squirrel harvests from three public hunting areas: Stephen A. Forbes Park, Marion County; Siloam Springs State Park, Adams and Brown counties; Kankakee River State Park, Kankakee and Will counties. Hunters are required to check out only and present any squirrels killed for examination. Squirrel seasons opened 1 September at Kankakee River and 15 September at Siloam Springs and Forbes Park in 1971-73. It should be emphasized that hunters are only required to check out of these areas; there is no real effort made to insure compliance and the ease of access to these forests means that many squirrel hunters do not stop at the check station. Moreover, hunter compliance varied between areas; all Kankakee River hunters reported even though they killed no squirrels, but hunters at Forbes and Siloam Springs rarely came into the check station without at least one squirrel.

At Forbes, there was a steady decline in the gray squirrel kill between 1971 and 1973 ($p < 0.10$). There was no significant difference in age ratios for either gray or fox squirrels in any year. This was also the case at Kankakee River, although fewer juveniles were killed in 1973.

THE UNIVERSITY OF CHICAGO
DEPARTMENT OF CHEMISTRY
1954

REPORT OF THE
COMMISSIONER OF THE
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AND
MINERALOGY
FOR THE YEAR 1954
PUBLISHED BY THE
BUREAU OF CHEMISTRY
AND
MINERALOGY
WASHINGTON, D. C.
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Siloam Springs was first opened to squirrel hunting in 1972. Apparently, populations of both squirrel species consisted mostly of adult squirrels; age ratios were abnormally low in 1972. In 1973, there was a significant increase ($P < 0.005$) in the number of juvenile gray squirrels killed. This pattern of an increased kill of juveniles after 1 year of hunting also occurred on the Crab Orchard Wildlife Refuge, Williamson County, Illinois, in 1952. The increase in juvenile kill may represent a lessening of juvenile dispersal as a result of fewer adults being present after a year of hunting or an increase in female fecundity in response to reduced squirrel densities. Both mechanisms may be involved. The gray:fox ratio did not change significantly ($P > 0.05$) between 1972 and 1973 at Siloam Springs.

There were some relationships between hunting pressure and squirrel kill on the public hunting areas. On the Siloam Springs and Forbes areas there was a significant correlation ($P < 0.05$) between the number of hunters and the total kill of both species of squirrels. This correlation was highest at Siloam Springs for fox squirrels ($r = +0.86$) and lowest at Forbes for fox squirrels ($r = +0.68$).

At Forbes, all sex- and age-classes of fox squirrels were positively and significantly correlated ($P < 0.05$) with the number of hunter trips and hunter hours. The adult female class had the highest correlation values ($P < 0.01$) with hunting pressure, which were significant every year between 1971 and 1973. However, for gray squirrels, only the kill of juvenile females was significantly correlated with hunting pressure, whereas adult males had the lowest correlation value ($r = +0.28$, $P > 0.90$).

At Siloam Springs, where approximately 80 percent of the kill was gray squirrels, the kill of juvenile female fox ($P < 0.01$) and juvenile female gray ($P < 0.05$) squirrels increased significantly with greater hunting pressure.

Only fox squirrels are present at Kankakee River. There was a significant positive relationship between the kill of juvenile males and females and hunting pressure but none for adults.

There were some meaningful relationships between the sex- and age-classes of squirrels and the weekly period when the kills occurred on the public hunting areas. Adult fox squirrels were killed in greater numbers early in the season at Kankakee River, where the adult fox squirrel kill was significantly ($P < 0.05$) and negatively correlated to the week of the season ($r = -0.73$, males; $r = -0.81$, females). At Siloam Springs, also, the kill of adult male fox squirrels was significantly greater ($P < 0.05$) at the beginning of the season, and the same was true for juvenile male gray squirrels. At Forbes, the kill of juvenile female fox squirrels increased later in the season.

Weekly kill samples were small for all three areas, and relationships between hunting pressures and the composition of the squirrel harvests should be considered preliminary.

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Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Our continuing study on the nest ecology of prairie chickens also provides basic information on the ecology of other species of wildlife that make use of sanctuary grasslands. Since 1963, an average of 410 acres of nest cover has been systematically searched for nests annually during June, July, and August. In addition to prairie chickens, which suffered poor seasons for nesting in 1973 and 1974 (MWRL 17(9):2-3), the nests of ground-nesting species including quail, pheasant, mourning dove, upland sandpiper, meadowlark, grasshopper sparrow, cottontail rabbit, and small mammals (prairie vole and southern bog lemming) were all sharply reduced in number in 1974. Over the past 12 years, averages of 21 quail nests, 13 dove nests (ground nests only), 60 meadowlark nests, 28 cottontail nests, and 2,135 small mammal nests have been found annually. However, in 1974, nest numbers were as follows: quail, 9; dove, 3; meadowlark, 28; cottontail, 1; and small mammal, 574. The first pheasant nest on sanctuaries at Bogota was found in 1969, and since then between 4 and 10 pheasant nests have been found annually.

On the basis of nests per acre, the above seven species (including prairie chickens) of ground-nesting birds were collectively 26 percent lower in 1974 than in 1973 and 17 percent lower than the 12-year mean. Cottontail nests per acre were 1,233 percent lower in 1974 than in 1973 and 1,900 percent lower than the mean for 7 years (1968-74). Densities of small mammal nests were 117 percent lower in 1974 than in 1973 and 260 percent lower than the mean for 9 years.

By contrast, nest densities for seven species of birds that do not nest directly on the ground, including short-billed marsh wren, red-winged blackbird, dickcissel, field sparrow, Henslow's sparrow, song sparrow, and goldfinch, plus aboveground nests of doves, were, collectively, 3 percent higher in 1974 than in 1973 and 34 percent higher than the 12-year mean. The largest and most meaningful samples among the off-ground nesters were those of the redwing, dickcissel, and field sparrow, with mean annual numbers of 239, 42, and 11 nests, respectively.

We believe that the sharp difference between nest numbers of on- and off-ground nesting fauna on sanctuary grasslands is largely a reflection of the extremely wet and therefore unsuitable conditions prevalent in 1973 and 1974 for species that nest directly on the ground. The on-ground nesters with their eggs and young likely constitute a much larger total biomass for predators than do the off-ground nesters. The relative stability or increase noted in off-ground nesters would not compensate for the declines in the on-ground nesters. Therefore, the net effect confronting the predator population would be a reduced prey population. Concomitant with the reduced food base for predators in 1973 and 1974 have been the highest rates of predation on prairie chicken nests since the project began in 1963.

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

February, 1975

Vol. 18, No. 2

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

In the last monthly report (MWRL 18:1-2), we presented some relationships between hunting pressure and squirrel kill on three public hunting areas: Kankakee River State Park, Kankakee and Will counties; Stephen A. Forbes State Park, Marion County; and Siloam Springs State Park, Adams and Brown counties. We have drawn certain conclusions regarding hunters and squirrel kills on these three areas.

In general, squirrel hunters who frequent public hunting areas for their sport are often not very proficient. This statement seems also to be true of Illinois hunters, but because all hunters are not checked, the true success rate is not known. It is certainly a fact that a comparison between the squirrel bag classes for our hunter cooperators and the bag classes from the three public areas shows them to be quite different. There are also considerable differences among our three public areas. These differences can be ascribed to two factors: (1) hunters at Forbes and to a lesser extent, Siloam Springs, that kill no squirrels do not report to the check stations; (2) hunters at Forbes, coming from a rural background, are more skillful squirrel hunters and kill more squirrels than hunters who frequent the other two areas. It seems likely that the Kankakee hunters are predominantly urban, are probably not particularly skillful hunters, and return to the check station whether or not they kill any game.

Hunter success rates at Kankakee River resemble those reported by other investigators, who found that more than one-half of all hunters contacted on public lands in Ohio, West Virginia, and Indiana, respectively, were unsuccessful in killing squirrels.

The average kill per trip on the three areas was lower than that of our hunter cooperators, who hunt almost exclusively on privately owned forests. At Forbes, hunters averaged 2.3 squirrels per trip; at Siloam Springs, 1.8; and at Kankakee River, only 0.59 squirrel per trip.

It is our belief that the Department of Conservation should make an increased effort to obtain reliable data on squirrel harvest on these public areas. Although many hunters who frequent these areas are not skilled, their cumulative numbers and persistence can generate high squirrel kills to the point of overharvest, at least on small woodlots.

NATURAL HISTORY SURVEY

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DEPARTMENT OF AGRICULTURE AND FORESTRY, ALABAMA

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A comparison of average squirrel harvests for a representative sample of other public hunting areas in Illinois shows considerable variation among them in yield per year. Yields are generally higher in northern Illinois, probably due to higher hunting pressures. Both Argyle Lake (McDonough County) and the McLean County area have produced particularly high yields in recent years.

We recommend that efforts be made to monitor mast crops, squirrel harvests, and hunting pressures and to collect samples of sex and age groups from public hunting areas throughout the state. We are now working with the Inventory Biologist, Mr. Jack Ellis, to help select areas for this study and to set up procedures to collect the necessary information.

These public areas must be managed under a concept of sustained harvest on a per acre rather than on a per hunter basis. This concept requires that squirrel harvests be carefully monitored each year, including the sex and age structure of the harvests.

Additional efforts should also be directed towards improving the forest habitat for squirrels on these public areas, including the use of timber sales where needed.

Our research work is designed to provide squirrel management guidelines for these public forests. We are studying the effects of nest boxes on fox squirrels, the effects of clear-cutting and selection cutting on both gray and fox squirrels, the effects of supplemental feeding in winter on both species, and methods for increasing hickory, the most important native squirrel food in Illinois.

The opportunity to hunt on private lands is lessening, thus placing more hunting pressures on public lands. This trend means that game managers must manage public areas more intensively, with active management programs designed to provide the hunter, whether hunting with gun, camera, or binoculars, a reasonable chance to find his quarry. The information needed for these programs can only be acquired through research, which can often provide methods for improving wildlife habitats at costs below those required by current programs.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

The nesting seasons of 1973 and 1974 were the poorest on record for the prairie chicken flock at Bogota (MWRL 17(9)). Predation of nests was much more frequent than in previous years (MWRL 18(1), 17(7 and 9)). The population of at least one species of predator has increased noticeably in recent years.

In the course of our fieldwork, especially in the booming season, we have recorded all observations of coyotes. These observations have increased each year since 1970. No coyotes were seen prior to that date. Subsequent observations are given in Table 1.

Table 1. Number of coyotes seen in Jasper and Marion counties, 1970-74.

Year	Coyotes
1970	3
1971	4
1972	6
1973	8
1974	16
Total	37

Of the total of 37 coyotes, five were seen on the peripheries of active booming grounds by observers in blinds. In the five instances, prairie chickens showed little or no reaction to the coyotes. The coyotes made no attempt to capture a prairie chicken and none of the chickens left the booming grounds. Apparently, adult prairie chickens on booming grounds have little to fear from coyotes. However, nests and incubating hens are much more vulnerable to coyotes foraging in the grasslands. Unfortunately, we know of no satisfactory method to determine from the remains of a destroyed nest what species of mammalian predator was responsible for its destruction. Therefore, we cannot evaluate the impact, if any, of the increase in numbers of coyotes on the nest success of prairie chickens.

The first part of the report deals with the general situation of the country and the results of the survey. It is followed by a detailed description of the various types of land use and the distribution of the population.

2. Description of the land use and the distribution of the population

Land use		Population	
Area (km ²)	Percentage	Number	Percentage
1	10	100	10
2	20	200	20
3	30	300	30
4	40	400	40
5	50	500	50
6	60	600	60
7	70	700	70
8	80	800	80
9	90	900	90
10	100	1000	100

The second part of the report deals with the detailed description of the various types of land use and the distribution of the population. It is followed by a detailed description of the various types of land use and the distribution of the population.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

March, 1975

Vol. 18, No. 3

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

How serious is the loss of nestling squirrels because hunters shoot nursing females during the early weeks of Illinois' squirrel season?

Using 1973 as a base year, we have estimated the loss of nestlings in both zones per 100 acres of forest land. We have based our estimate on reports from our hunter cooperators, on breeding rates of female squirrels examined during the summer and fall in Illinois, and on breeding rates reported for both gray and fox squirrels throughout their occupied range.

We found that the loss averaged about eight nestlings per 100 acres of forest in both zones.

To place this loss in perspective, we need to consider the density of the fall squirrel population that experiences such losses. Average fall densities of squirrels equal or exceed 100 squirrels per 100 acres in most of the Illinois squirrel range. Livetrapping and tagging studies have produced estimated densities of 1.7 (fox squirrels, Piatt County), 1.7-2.2 (mixed population of fox and gray squirrels, Vermilion County), and 1.5-1.8 (both species, Pope County) squirrels per acre in Illinois in mixed hardwood stands 40+ years old. These densities indicate that a loss of 8-10 nestlings per 100 acres represents less than 10 percent and probably nearer 5 percent of the fall squirrel population. At present harvest levels, such losses seem easily sustainable and have not appeared to affect the year-to-year squirrel harvest.

There is evidence for gray squirrel populations, both hunted and protected, that the postweaning survival of summer-born young is substantially less than for spring-born young. Most of these summer-born squirrels become active after 15 September, when there are fewer young of buffer species available to absorb predator pressures. They must spend much of their time on the ground hunting food, which is mostly eaten or cached by other squirrels, and must defend themselves against adult squirrels and spring-born young who are usually quite intolerant of these recently weaned juveniles. In most years, these summer-born young are not recruited into the population as permanent residents, but disperse or die. It seems likely that a similar situation also occurs with fox squirrels.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

The high predation rates on prairie chicken nests at Bogota in 1973 and 1974 prompt us to promote the development of the most predator-resistant habitat possible on nest sanctuaries, if indeed such habitat exists. In 1974 three general cover types appeared to fit this description: (1) prescribed-burned plots of mixed prairie grasses, redtop, timothy, orchard grass, and brome that were in the second nest season after burning in March; (2) new seedings of redtop, timothy, legumes, and wheat stubble in the second or third nest season after seeding; and (3) in one instance, a well-drained old sod composed mainly of redtop, yarrow, and dewberries. Twenty-nine percent (7) of the hatched prairie chicken nests found on sanctuaries in 1974 were in second-year March burns, which comprised only 4 percent (26 acres) of the total of 400 acres searched. Twenty-five percent of the hatched nests were in new seedings, which comprised 18 percent of the cover searched. Twenty-one percent of the hatches were in a well-drained old sod on the Donnelley Sanctuary, which comprised 8 percent of the cover searched. Hatch success was 54 percent in the second-year March burns, 50 percent in the new seedings, and 57 percent in the well-drained old sod, all of which were higher than the overall mean success rate of 41 percent in 1974.

The poorest hatch success in both 1973 and 1974 was in all categories of vegetation after prescribed burns made in August. In contrast, during the years 1969 through 1972, the vegetation that was present after August burns provided some of the highest densities of nests and the highest hatch success. Likewise, from 1969 through 1971, the vegetation after burns made in March showed good densities of nests and good nest success. Then in 1972 and 1973, March burns were among the poorest cover for nesting prairie chickens.

Many variables and limited sample sizes in some categories for some years are involved in these data. Thus, we are unable at this time to draw any strong conclusions regarding cover types and management practices that will work well for nesting prairie chickens every year under all conditions. Renovation of old sods is essential both by plowing and reseeding and by prescribed burning. However, in numerous instances the abnormally wet conditions prevailing in 1973 and 1974 prevented plowing and reseeding operations on the sanctuaries. The extreme wetness also made prescribed burning of the desired intensity and acreage impossible during the past 2 years.

CHAPTER 10: THE HISTORY OF THE UNITED STATES

The history of the United States is a complex and multifaceted story that spans centuries. It begins with the indigenous peoples who lived on the continent long before the arrival of European settlers. The story of the United States is one of exploration, discovery, and the struggle for freedom and independence. The American Revolution was a pivotal moment in the nation's history, leading to the birth of a new country. The years following the Revolution were marked by westward expansion and the growth of the nation. The Civil War was a defining moment in the nation's history, leading to the abolition of slavery and the preservation of the Union. The Reconstruction era was a period of significant change and progress, but it was also a time of struggle and hardship. The late 19th and early 20th centuries were a period of rapid growth and change, with the United States emerging as a major world power. The 1920s and 1930s were a time of economic hardship and social change, leading to the New Deal and the rise of the American middle class. The 1940s and 1950s were a time of war and the Cold War, leading to the United States becoming a superpower. The 1960s and 1970s were a time of social and political upheaval, leading to the Vietnam War and the civil rights movement. The 1980s and 1990s were a time of economic growth and technological advancement, leading to the United States becoming a global leader. The 21st century has been a time of significant challenges and opportunities, with the United States facing global issues such as climate change and terrorism. The history of the United States is a story of resilience and the pursuit of the American dream.

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MONTHLY WILDLIFE RESEARCH LETTER

MAY 5 1975

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Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

April, 1975

Vol. 18, No. 4

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Intermediate cutting, featuring the cutting of individual trees or a small group of trees, is used to remove mature to overmature trees, to improve species composition and spacing, and to release younger trees for future growth. Intermediate cutting is used throughout Illinois on many timber stands each year, yet little is known about the effects of this timber cutting on forest wildlife. Squirrels, because of their dependence on large mast-producing trees for food and shelter, may be particularly affected by this practice.

We have been monitoring the response of the squirrel populations to intermediate cutting on two areas in the Shawnee National Forest in Page County, Illinois. We livetrapped and tag squirrels prior to and for 2 years after the timber cutting.

The Massac Tower Sale, 44 acres in size, was cut during the summer and fall of 1973. A total of 761 trees were marked for sale, and 647 (85.0 percent) were trees capable of producing food for squirrels. This represents a removal rate of 14.7 trees per acre, all of them large dominant trees.

All den sites observable from the ground were tallied on the area prior to cutting. A similar count was conducted after cutting was completed. There were 87 possible nest cavities and 100 escape-only cavities prior to cutting. After cutting, only 48 nest cavities (a 44.8 percent decline) were found on the area. Only 6 of the 100 escape dens found prior to cutting were removed by the timber sale.

Nest dens were not particularly abundant on the Massac area (1.9 per acre) prior to cutting, and nearly half were removed in the timber harvest. Many of the escape cavities were at ground level and probably resulted from fires.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

This spring (1975), as in past springs, booming ground surveys were conducted along with supplementary observations made by visitors in blinds at Bogota almost daily from 22 March through 20 April.

The peak count for each booming ground this spring revealed a total of 102 cocks on the Bogota Area, a decline of 28.7 percent from the peak count of 143 cocks in the spring of 1974. This was the second consecutive decline

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since the population began a steady increase from the low point of 37 cocks in the spring of 1968. As in the preceding spring, the decline this spring can be directly attributed to the poor nesting season of 1974. Our intensive nest studies at Bogota in both 1973 and 1974 documented the lowest levels of nest success (31.1 percent and 40.7 percent, respectively) in 12 years. As described in preceding reports, 3 years of abnormal weather (mostly too wet) and its detrimental effects on nest cover, the reduced food base of predators, and a high rate of predation on nests (and probably broods, also) were the main interrelated factors to which the poor hatches of 1973 and 1974 were attributable.

Despite the population decline, continued improvement was noted on the 80-acre Jamerson McCormack Sanctuary on the south edge of the study area this spring. Nine cocks boomed, with up to 11 hens, on and near the McCormack 80 this spring, compared with 4 cocks in 1974, 2 cocks in 1973, and 1 cock (the first since acquisition in 1965) in 1972. All booming grounds were located either on or within about 100 yards of the sanctuaries at Bogota.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Helen C. Schultz, Editor

Urbana, Illinois

May, 1975

Vol. 18, No. 5

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

The intermediate timber harvest on the Massac sale area was described in the last report (MWRL 18(4)) in terms of its effect on food and shelter for squirrels. In this report we will consider the effect of the timber harvest on the squirrel populations. Sixty percent of the squirrel population on the area was composed of gray squirrels, and there was no change in this proportion of gray squirrels after cutting.

The timber cutting appeared to affect gray squirrels more than fox squirrels. Survival rates for all sex- and age-classes of gray squirrels averaged 40.0 percent between May 1973 and March 1974, the period when the timber was being cut and removed. In contrast, survival of all sex- and age-classes of gray squirrels averaged 86.7 percent between March 1974 and March 1975, after cutting was completed. Nine of 10 fox squirrels survived the timber cutting.

Movement patterns also changed after cutting, but differed between species. There was a significant ($P < 0.05$) increase in livetrapp captures of fox squirrels after cutting for traps 1-9, located adjacent to uncut mature timber. Of eight adult fox squirrels, five experienced no significant shift in home range and three moved south to the edge of the sale area adjacent to the uncut forest. Of two juvenile fox squirrels, one remained within the cut and the other disappeared from the study area.

For gray squirrels, there was a significant increase ($P < 0.05$) in their capture rates in traps 29-37, which traverse the center of the cutover area.

Five of 12 adult gray squirrels captured before cutting began remained on the same ranges, 1 moved to the adjacent uncut forest, and 6 disappeared. All three juvenile gray squirrels marked prior to cutting disappeared from the study area after cutting.

In terms of total density of squirrels, the timber cut appeared to have little or no effect on the squirrel population. The estimated density of squirrels was 49 in 1973 and 47 in 1975. We actually captured six more squirrels in 1975 (31) compared with 1973 (25).

Apparently, the Massac sale area did not support a particularly high density of squirrels prior to the sale (1.1 per acre). At this density, the loss of nearly half the nest dens and an appreciable amount of food did not lower the

number of squirrels. Therefore, there must be sufficient life-supporting elements remaining in the timber sale area to support this density of squirrels. The timber cutting did result in increased mortality or in shifts of home range for some of the resident squirrels, but 18 months after the sale, squirrel numbers have stabilized at precutting levels.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeler,
D. R. Vance

The annual booming ground surveys were conducted on seven areas in five counties of south-central Illinois in the spring of 1975. A total of 175 prairie chicken cocks was counted on these seven areas. This total includes the flock at Bogota whose status was reported in the April issue of the MWRL.

The two flocks dependent on sanctuaries in Marion County increased 24 percent from 38 cocks in 1974 to 47 cocks in 1975. The flock near Farina increased from 25 cocks to 35 cocks. The flock near Kinmundy-Forbes Park declined from 13 cocks to 12 cocks.

The four remaining flocks not associated with sanctuaries declined 22 percent collectively from 1974 to 1975. The flock near Mt. Erie in Wayne County declined from nine cocks to eight cocks. The Clay County flock near Bible Grove dropped from eight cocks to four cocks. The flock near Hoyleton in Washington County declined from 10 cocks to 9 cocks. A new booming ground was located near New Minden in Washington County about 4 miles west of the Hoyleton booming ground. Five cocks were counted on this new ground. Excluding the previously uncensused New Minden flock, the total state population of prairie chickens diminished by 18 percent from 1974 to 1975. The flocks associated with sanctuaries in Jasper and Marion counties constitute 85 percent of the known statewide population of prairie chickens.

In general, the small flocks outside the main sanctuary area at Bogota fared better than the Bogota flock. The difference is probably due to the small numbers of birds involved in the outlying flocks. The hatching of only one or two clutches would probably be sufficient to maintain populations at such low levels. Such small flocks could not contribute importantly to the total biomass available to nest predators. Prairie chicken nests would be so few and probably so scattered that they would not be readily found by nest predators.

The Bogota flock, on the other hand, is large enough to provide readily available prey. In fact, the density of prairie chicken nests on sanctuaries at Bogota exceeded by 15 percent (1973) and by 42 percent (1974) the density of nests of all other ground-nesting birds combined. Other ground-nesting species include quail, pheasant, mourning dove, upland sandpiper, meadowlark, and grasshopper sparrow. As previously reported (MWRL 18(1):3), predation rates on prairie chicken nests at Bogota in 1973 and 1974 were the highest recorded since the project began in 1963.

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MONTHLY WILDLIFE RESEARCH LETTER

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Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

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Manipulation of Pheasant Habitat

R. E. Warner

Early morning roadside counts of pheasants on the Sibley Study Area (SSA) were made on eight consecutive mornings, 15 April through 22 April 1975. A total of 511 pheasants (130 cocks, 381 hens) were observed over 194 miles of driving. The number of pheasants observed per mile (2.6) in 1975 was approximately 50 percent fewer than had been observed in April 1974 and 2 percent fewer than in April 1973.

Early morning roadside counts for the Ford County Management Unit (FCMU) were made on 21, 23, and 25 May 1975. A total of 282 pheasants (111 cocks, 171 hens) were observed over the 120 miles of driving (40 miles per morning). The number of pheasants observed per mile (2.4) in 1975 was approximately 59 percent fewer than had been observed in May 1974 and 67 percent fewer than in May 1973. Thus, the spring roadside counts in 1975 reflect the decline in pheasant numbers that resulted from the poor nest success in 1974 (MWRL 17(9):1-2).

Favorable weather facilitated early planting of row crops in 1975. Most area farmers completed planting by about 15 May. As a result, there was considerable early mowing of roadsides and hayfields. Most hayfields on the SSA and FCMU had been harvested by 14 June, so that a large percentage of early nests were destroyed.

It is most significant to this study that approximately 25 percent of the roadsides on the FCMU were mowed by 1 June this year (1975). Since that date, periodic rainfall, cultivation activities, and (possibly) IDC press releases encouraging support for delayed mowing have contributed to the discontinuation of most mowing activities on the FCMU and much of Ford County during June. Observations of the number of unmowed roadsides as well as contacts with farmers indicate that public acceptance of the importance of delayed mowing may be expanding in areas adjacent to the FCMU. The apparent acceptance by farmers of the concept of delayed mowing to provide essential nest cover for pheasants is one that should be stressed and evaluated more extensively in 1976.

Ecology and Management of SquirrelsC. M. Nixon,
S. P. Havera

The Old Barn sale, featuring a 27-acre intermediate cut and a 7-acre clear-cut, is the second area used to monitor the effects of intermediate cutting on squirrels.

This area, located in Pope County, was cut in the summer of 1974 after being livetrapped in March 1974. The area was livetrapped again in March 1975 and will be trapped once more in March 1976.

A total of 411 trees were marked for sale, 392 of which were capable of producing food for squirrels. The sale area is narrow (100-200 meters wide) and is located on a steep, rock-covered, north-facing hillside bordering Lusk Creek.

As on the Massac area (see MWRL 18(4, 5):1), the timber cutting at Old Barn does not appear to have affected the density of the squirrel population. The estimated density was virtually the same before and after the cut (1.9 squirrels per acre).

Both before and after the cutting, many of the livetrapped squirrels came from what is now the uncut perimeter of the sale. Thus, foraging activity must have remained about the same in the sale area after the timber cutting. In fact, we captured 16 more squirrels in the postcut trapping (43) than we did during the precut trapping (27). Comparisons of survival rates during the cutting years (1974-75) with the postcut year (1975-76) must await the results of next year's trapping.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Interaction between native and introduced species is a well-known phenomenon. However, interrelationships among such species as prairie chickens and pheasants have not been well documented. We are in a unique position to document interactions between these two species on the Bogota Study Area.

As reported in MWRL 14(3):3, during the years 1963 through 1968, only an occasional pheasant was seen or heard crowing at Bogota during our booming ground surveys for prairie chickens. Four pheasant cocks were noted crowing on sanctuaries in 1969, followed by a steady increase to 14 cocks in 1974. By the spring of 1975, at least 18 cocks were noted on sanctuaries and at least 4 cocks crowed routinely on private land. Pheasants gained occupancy on every sanctuary at Bogota by 1975--despite our efforts to control pheasants on sanctuaries by shooting them at every safe, legal, and discreet opportunity. Collected specimens are used for mineral profile analyses at the Survey.

The close association of pheasants and prairie chickens has resulted in the following observations: (1) aggressive harassment of prairie chicken cocks on booming grounds; (2) pheasant cocks courting prairie chicken hens; (3) competition for space on sanctuaries for crowing territories, nest territories, and brooding areas; and (4) nest parasitism. The full import of these observations is difficult to ascertain. Other aspects have not been observed, such as the behavior of a pheasant in the presence of a brood of prairie chickens.

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The first pheasant nest on a prairie chicken sanctuary was found in 1969, and since then from 4 to 10 pheasant nests have been found annually. In addition, nine cases of nest parasitism were discovered between 1970 and 1974. Although pheasant eggs have been found in only 1 to 5 percent, annually, of a total of 380 prairie chicken nests during this 5-year period, 3 of 16 prairie chicken nests (19 percent) found as of 18 June this summer contained pheasant eggs. In two of these three instances this summer, pheasants probably caused the failure of the prairie chicken nests. One nest containing six prairie chicken eggs and four pheasant eggs was abandoned. The other nest contained 12 intact prairie chicken eggs, most with dead 22- or 23-day embryos, and 7 pheasant eggs, 5 of which had hatched. According to work by Dr. H. H. Shoemaker of the University of Illinois, the incubation period of prairie chickens is 25 days whereas that of pheasants is 23 days. It remains a moot question whether a prairie chicken or pheasant hatched the pheasant chicks and abandoned the nearly full-term prairie chicken embryos. Both of the above nests were typical prairie chicken nests, as prairie chicken feathers were incorporated into the nest bowls.

Pheasant broods are also commonly noted on the sanctuaries at Bogota. On the Yeatter and Mark sanctuaries, where pheasant broods were most commonly observed in 1974, the numbers of prairie chickens on booming grounds dropped about 50 percent between 1974 and 1975--the overall drop was 29 percent at Bogota. On the sanctuaries in Marion County, where pheasants are not present (fortunately), one flock (Kinmundy) held stable and another (Farina) increased 40 percent between 1974 and 1975 (MWRL 18(5):2). We have no reason to believe that predator populations and adverse weather were dissimilar in Jasper and Marion counties in 1973-74.

It is possible, but unsubstantiated, that stocking of pheasants by local sportsmen is supplementing natural reproduction on the Bogota area. Stocking of pen-reared birds would increase the potential for introducing disease to prairie chickens. Whether the pheasants at Bogota are the result of natural reproduction, stocking, or both, their presence also provides a temptation to hunters to trespass on sanctuaries and therefore increases the likelihood of shooting prairie chickens.

The problem is thus twofold: (1) the desire of local farmers and sportsmen for pheasants presents a people problem, and (2) the presence of pheasants poses a threat, or at least an additional adverse factor, to prairie chickens and their ultimate preservation for the people of Illinois as a whole.

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Manipulation of Pheasant Habitat

R. E. Warner

From 28 June to 18 September in 1972 and 1973, a radiotelemetry project was conducted to determine cover preferences by pheasant broods on the Sibley Study Area (SSA). A Master of Science thesis concerning this study was completed by R. E. Warner and submitted to the University of Illinois in May 1975.

Information on cover utilization was successfully collected for eight different broods ranging from 1 to 12 weeks of age during the course of the study. Two of the radio-tracked broods were known to have hatched on SSA experimental roadsides. All eight broods made primary use of either an oat field (seven broods) or a hay field (one brood). These results indicated that oats in particular and hay were fundamental roosting and feeding cover for east-central Illinois broods throughout July, August, and early September. It was hypothesized that necessary high-protein insect foods were readily available in oats and hay.

Brood age was shown to be of more influence than crop phenology (season) or hay and small grain harvest in the significant gradual increase in the use of corn and soybeans and in the corresponding decline in the use of oats and hay. Broods 6 weeks of age and less made more extensive use of oats and hay than did older broods.

The results of this study substantiated that oats and hay have traditionally been preeminent in the successful rearing of juvenile pheasants in east-central Illinois. When the radiotelemetry project was initiated in 1972, hay, pasture, and small grain acreages had been reduced from nearly 30 percent in 1962 to 6.7 percent of the SSA land area. By 1974, these acreages had diminished to 3.9 percent. The extent to which hay and small grains have declined presumably eliminates the opportunity for many broods hatched on roadsides to utilize this optimal brood habitat.

In order to determine where seeded roadsides may be most successfully utilized by the ringneck in Illinois' prime pheasant range, it will be necessary to understand the well-being of pheasant broods produced on roadsides not in close proximity to hay or small grain fields.

The third season of nest searches along roadsides in the Ford County Management Unit (FCMU) will be completed this summer, in conjunction with annual early-morning brood counts that have been conducted on the FCMU since

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1967. On the basis of this information the following analysis will be made: (1) nest placement along seeded roadsides in relation to distance from nearest hay, pasture, and small grain fields; and (2) positioning of broods observed along roadsides during early-morning brood counts in relation to distance from nearest hay, pasture, and small grain fields. These tests will be helpful in evaluating the possible need to initiate more extensive radiotelemetry work and perhaps a study of the food habits of broods in order to ascertain whether managed roadsides adjacent to row crops can sustain pheasant broods in the absence of supportive hay and small grain cover.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Two study areas were established on the Forest Glen County Preserve in Vermilion County, Illinois, for a determination of the effects of winter feeding on squirrels. Both the control area (B) and the experimental area (A) are 12.96 hectares (32.03 acres) and consist mainly of mature oak and hickory species with fair numbers of sugar maple, beech, ash, tulip poplar, and basswood.

Four feeder sites were chosen on the experimental area so that each site was at the center of one of four areas of equal size. Each feeder held approximately 1 bushel of shelled corn. The feeders were filled on 19 December after 10 days of livetrapping. The feeders were checked about every 2 weeks until they were emptied on 13 March. Feeder use appeared to be heavy by squirrels. On 31 January, three to four sets of squirrel tracks were seen at each feeder in fresh 4-inch snow. The areas were livetrapped again 1-10 April.

The winter of 1974-75 was not one that favored winter feeding. The weather was relatively mild and the fall mast crop was excellent, with white oak, hickories, and walnuts abounding. The abundant mast crop allowed squirrels to enter the winter season in excellent physical condition.

In December on the experimental area (A), 23 squirrels were caught; 13 were fox squirrels (Sciurus niger) and 10 were gray squirrels (S. carolinensis). On the control area (B), 14 were caught, all of which were fox squirrels. In April, the control area was trapped for only 7 days because of unusually cold nightly temperatures. Twenty squirrels (17 fox) were caught during the 7-day period in April on Area B. Eleven of these squirrels had been trapped in December. Area A was trapped for 10 days in April. Thirty squirrels were caught during 7 days of trapping and 34 (20 fox) were caught during the full 10-day period. Twenty of the 23 tagged in December were recaptured in April.

In December for Area A, the number of captures per thousand trap nights was 63.9. On Area B, the control area, the number of captures per thousand trap nights was 38.9. Seven days of trapping resulted in 119.1 captures per thousand trap nights on Area A in April and 79.4 captures per thousand trap nights on Area B. The number of captures per thousand trap nights for 10 full days of trapping on Area A during April was 94.4.

Both areas showed an increase in the squirrel populations from December to March. This increase may be partially due to the greater ease of trapping squirrels in late winter and early spring, when food supplies are much lower than in early winter. The percentage change in the population indices for a 10-day trapping period in December and a 7-day period in April for Area A was +86.3 for the number of captures per thousand trap nights. This value for Area B was +104.1. If the 10-day trapping values in April for Area A are used, the increase on Area A was 47.8 percent. Thus, Area B, the control area, had an increase in population indices that was similar to that on the experimental area.

The effects of winter feeding on the population estimates on Area A are not precisely determined. In both trapping periods, more squirrels were caught on the experimental area than on the control area. However, chi-square tests on the number of squirrels caught per thousand trap nights yielded no significant difference ($P > 0.05$) between Areas A and B in December for 10 days of trapping and in April for 7 days of trapping. However, one effect of supplemental feeding may have been to attract squirrels to the area that were not there prior to the feeding. On the basis of captures per thousand trap nights in April, 51.6 squirrels were caught on Area A that were not captured in December as compared with 35.7 on the control area. Winter feeding may therefore have influenced some squirrels to move onto the area, at least for feeding purposes.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

During the spring of 1975, 437 people visited the prairie chicken booming grounds in Jasper County on a reservation basis. Beginning with 56 people in 1966, when records were first kept, the number of visitors has gradually increased each spring and has totaled 2,714 to date. Duplications probably amount to about 10 percent. This spring, 60 groups representing 16 different universities or colleges, 9 different Audubon clubs, and various other agencies and interested individuals were involved on 29 mornings. We try to limit the number of individuals to 20 per morning. Illinois supplied 59 percent of the visitors this spring, Indiana 22 percent, Ohio 10 percent, and lesser numbers came from Pennsylvania, Missouri, Tennessee, Kentucky, and Washington, D. C.

As in past springs, visitors aided the research project by recording their observations on standard forms during 78 blind mornings (one or more observer per blind per morning). Observer records indicated that the period of 29 March through 13 April was the peak period of hen visitation on the display grounds. The first copulation in 1975 was noted on 1 April and was followed by a peak in mating activities between 6 April and 14 April. A total of 55 copulations were reported by observers in blinds this spring.

Marsh hawks continued to be the most common source of disruption on the booming grounds; harriers were noted on 61 of the 78 blind mornings this spring. There was no evidence of kills of prairie chickens by harriers, but among such

common raptors as short-eared owls, rough-legged hawks, and red-tailed hawks, circumstantial evidence indicated one kill by a redtail. Cock pheasants were seen during 12 blind mornings. On two of these mornings, aggressive behavior by pheasants toward prairie chickens was noted. Visitors also witnessed a few interactions between prairie chickens and crows, coyotes, raccoons, dogs, and killdeer. Airplanes also caused some disturbance among prairie chickens.

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Manipulation of Pheasant Habitat

R. E. Warner

Land-use trends on the Sibley Study Area (SSA) sustained the same magnitude of corn and soybean farming that has prevailed in east-central Illinois over the past several years. Row crop acreages comprised 88.8 percent of the SSA in 1975 and 89.1 percent in 1974 ($\bar{X} = 86.0$ percent, 1970-75). Hay acreages were recorded at a new low of 1.3 percent (246 acres) of the SSA in 1975, decreasing from 1.5 percent in 1974 and 2.0 percent in 1973. Small grain acreages comprised 2.5 percent (583 acres) of the SSA in 1975, 1.8 percent in 1974, and 2.5 percent in 1973.

Land-use patterns on the Ford County Management Unit (FCMU) were similar. Hay comprised 1.1 percent (116 acres) of the FCMU in 1975, 1.2 percent in 1974, and 2.2 percent in 1973. Small grains declined to 2.8 percent (257 acres) in 1975, compared with 3.8 percent in 1974 and 3.6 percent in 1973.

Nest studies conducted in 1975 on the SSA and FCMU revealed a substantial decline in numbers of established and hatched nests per acre in most cover types that were searched (see Tables 1 and 2). It was determined that roadsides, small grains, hay, pasture, strip cover, and nonagricultural cover on the FCMU yielded estimates of 510 hatched nests in 1973, 297 in 1974, and 165 in 1975. Thus, on the FCMU, productivity on these cover types declined 45 percent in 1975, compared with 1974.

Seeded roadside cover on the FCMU in 1975 did not resume the status of principal nesting habitat, as evidenced in 1974 and 1973. Roadsides produced only 26.1 percent of successful nests in 1975, diminished from 58.3 percent in 1974 and 38.8 percent in 1973 (see Table 3). These data provide clear indication that the relative importance of seeded roadsides for nesting has declined on the FCMU in 1975.

However, in perspective, the densities of hatched nests on FCMU roadsides in 1975 indicated a relative decline of only 22.0 percent from 1974, whereas the densities of hatched nests on SSA unmanaged control roadsides declined 47.1 percent from 1974 (Table 4).

Understanding the implications of this 1975 decline in roadside nesting with respect to future years is difficult. Accurate assessment of any potential diversion in preference for roadside cover is made additionally difficult because of an increase in early mowing of FCMU roadsides by farmer cooperators. In 1975, 60 percent of the searched roadside plots were mowed at least once by the time the second nest search was conducted (21-31 July), which represents a substantial increase over the 12 percent and 15 percent of mowed roadside plots in 1974 and 1973, respectively. Implementation of a continued term of nest studies on the FCMU will be carefully considered in view of the 1975 decrease in the establishment and success of nests on roadsides.

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Table 1. Established and Hatched Nests per Acre on the FCMU, 1974 and 1975.

Cover Type	1974		1975	
	Established	Hatched	Established	Hatched
Roadsides	2.50	1.23	1.23	0.27
Small Grains	0.21	0.03	0.29	0.06
Hay	0.96	0.33	0.86	0.02
Pasture	0.40	0 ⁺	0.64	0 ⁺
Strip & Nonagricultural	0.56	0.14	0.59	0.17

Table 2. Established and Hatched Nests per Acre on the SSA, 1974 and 1975.

Cover Type	1974		1975	
	Established	Hatched	Established	Hatched
Roadsides	0.54	0.17	0.23	0.08
Small Grains	0.11	0.05	0.11	0.08
Hay	0.82	0.16	0.96	0.12
Pasture	0.70	0.15	0	0
Strip & Nonagricultural	0.77	0.23	0.30	0.06

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Table 1. Results of the first round of the experiment (N = 100)

Round	Group 1		Group 2		Total
	Success	Failure	Success	Failure	
1st	100	0	100	0	200
2nd	100	0	100	0	200
3rd	100	0	100	0	200
4th	100	0	100	0	200
5th	100	0	100	0	200

Table 2. Results of the second round of the experiment (N = 100)

Round	Group 1		Group 2		Total
	Success	Failure	Success	Failure	
1st	100	0	100	0	200
2nd	100	0	100	0	200
3rd	100	0	100	0	200
4th	100	0	100	0	200
5th	100	0	100	0	200

Table 3. Estimated Production of Successful Pheasant Nests per Section on the FCMU, 1973-75.

Cover Type	1973		1974		1975	
	Number of Nests	Percent	Number of Nests	Percent	Number of Nests	Percent
Roadsides	12.4	38.8	10.8	58.3	2.7	26.1
Strip & Nonagricultural ^a	9.1	28.5	4.9	26.3	6.5	63.0
Hay	6.6	20.7	2.2	12.1	0.2	1.8
Small Grains	1.7	5.3	0.6	3.3	0.9	9.1
Pasture	2.1	6.7	0 ⁺	0 ⁺	0 ⁺	0 ⁺
Total	31.9	100.0	18.5	100.0	10.3	100.0

^a Strip cover consists of fencerows, waterways, travel lanes, and drainage ditches; nonagricultural cover consists of abandoned farmsteads, waste areas, and ungrazed woodlots.

Table 4. Percentage of Decline (in 1975 and 1974) in Densities of Established and Hatched Nests on SSA and FCMU Roadsides.

Roadsides	Established Nests Per Acre	Hatched Nests Per Acre
FCMU, seeded ^a	(-) 49.2%	(-) 22.0%
SSA, unmanaged control ^b	(-) 42.6%	(-) 47.1%

^a Calculated from nest densities listed in Table 1.

^b Calculated from nest densities listed in Table 2.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

In the previous monthly newsletter (MWRL 18(7):2-3), the effects of supplemental feeding during winter on squirrel populations were discussed. Some other results from the study are mentioned in this report.

All squirrels trapped were examined for sarcoptic mange (Sarcoptes scabiei), a possible indication of an inadequate diet. In December, 3 of 23 squirrels on Area A (experimental) and 1 of 14 on Area B (control) had mange--no significant difference. However, in April, on the control area, there was a significant increase ($P < 0.025$) in the number of animals with mange. Of the 20 animals caught, 10 (50 percent) had mange and 2 were severe cases. In contrast, on the area with supplemental feed, 7 out of 34 (21 percent) had mange and 2 were severe cases. This difference in the frequency of mange occurrence in April between the two areas approached the 5 percent level of significance. It appears that the shelled corn may have had some effect on the occurrence of mange on the experimental area. Nineteen (91 percent) of the 21 squirrels with mange, December and April counts combined, were fox squirrels.

Winter feeding may benefit a squirrel population by enabling the mature females to maintain a sufficiently good physical condition so that they enter heat and breed during the winter. Eighteen mature females were caught in December and only one (on Area A) had a fall litter. However, in April, the majority of mature females on both the control and the experimental areas were nursing young or were pregnant. On the experimental area, seven of nine (78 percent) mature female fox squirrels were lactating and another captured female, a gray squirrel, was pregnant. On the control area, four of the six (67 percent) mature female fox squirrels captured were lactating and one was in heat. Both adult female gray squirrels captured on Area B were lactating. It appears that the abundant mast supply the previous fall and the relatively mild winter was favorable to squirrel reproduction.

Squirrels having access to a permanent source of corn during the winter months may maintain a relatively stable body weight throughout the winter. Although supplemental corn does not supply a perfect nutritional balance, it should provide a ready and stable source of caloric intake in a relatively short time. Squirrels were weighed to the nearest 0.1 gram on their first capture during December and April on both areas to note weight differences on the same area and between areas. Theoretically, the squirrels on the experimental area should have lost proportionally less weight and should have had a higher average body weight in April than squirrels on the control area.

For the weight analysis, the squirrels were broken down into sex- and age-classes. The best sex- and age-class for noting weight variation is the adult male class because the weights of adult males are not biased by growth as in younger age-classes or by pregnancy and lactation as in the adult female age-class.

On Area A, the average weight in December for adult male fox squirrels was 854.7 g (N = 6). In April it was 763.4 g (N = 8). The average loss was 91.3 g or 10.7 percent. Area B, the control area, had a decrease of 7.8 percent in the weights of adult male fox squirrels, averaging 801.1 g (N = 3) in December and 821.3 g (N = 7) in April. For the same animals caught in both December and April, the percentage of weight loss was a little smaller on Area A, 90.0 g (10.6 percent, N = 5), than on Area B, 101.8 g (11.4 percent, N = 3). There were no significant differences in the weights of adult male fox squirrels between Areas A and B in December nor on Area B between December and April. However, a significant difference ($P < 0.001$) in weight loss did occur on Area A between December and April, and the differences in the April weights between the two areas approached the 5 percent level of significance, with the average weights on the control area being higher. These differences may be partially explained by the small number (N = 3) of adult male fox squirrels caught on Area B in December.

Weight declines also occurred in adult female fox squirrels. On Area A, the average loss was 63.1 g or 7.4 percent. However, five of the six adult females caught in April were lactating. On Area B, the average loss was 15.1 g or 1.7 percent, less than on Area A, probably because only two of the four females caught in April on B were lactating and one was in heat. There were no significant differences between the weights of adult females on Areas A and B in December nor on Area B between December and April. However, a significant loss did occur on Area A between December and April ($P < 0.05$), and the adult females on Area B were significantly heavier than those on Area A in April ($P < 0.001$).

In other sex- and age-classes, tests where sample sizes were large enough for comparison yielded no significant differences between squirrels on the same areas in December and April nor between areas during the same month. Female fox squirrels of the subadult-yearling group varied similarly on the two areas. Weights for three animals on Area A declined 0.9 percent between December and April whereas three animals on Area B lost an average of 4.2 percent in weight.

Most of the gray squirrels captured were on Area A. The adult male class varied from a December average of 547.0 g (N = 1) to 550.4 g (N = 2), an increase of 3.4 g (0.6 percent). The adult female group varied from an average of 566.2 g (N = 5) in December to 529.5 g (N = 7) in April. The average loss was 36.7 g (6.5 percent), but six of the seven females caught in April were lactating and the other was pregnant. Five female gray squirrels were caught in both December and April. Their weights decreased 7.6 percent from December to April.

Subadult gray squirrels trapped on Area A did not lose weight. Three male gray squirrels averaged an increase of 10.8 percent between December and April and one subadult female maintained the same weight.

In summary, supplemental feeding during the winter of 1974-75 did not result in substantial benefits for squirrels on the experimental area. There was a significantly ($P \approx 0.05$) lower frequency of mange on the experimental area and a higher capture of new animals on the area with supplemental feed than on the control area (51.6 vs 35.7 squirrels captured per thousand trap nights, respectively). The number of captures per thousand trap nights and changes in this index between December and April were similar on the two areas, although the actual number of squirrels captured was higher on the experimental area in both December and April. Reproduction was high on both areas--the majority of mature females captured had spring litters. The average weights of adult fox squirrels were higher on the control area than on the experimental area in both December and April. Significant weight losses occurred in both male and female fox squirrels on the experimental area between December and April. Although fewer gray squirrels were caught than fox, the gray squirrels had more stable body weights on the experimental area from December to April than the fox squirrels.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

For the third consecutive year, nest success on the sanctuaries at Bogota was below 50 percent. Of the 58 nests found this summer, 5 (8.6 percent) were abandoned, 29 (50 percent) were destroyed, and 24 (41.4 percent) were successful. Hatch success in 1975 was essentially unchanged from 1974 (40.7 percent) despite much more favorable weather conditions during the spring and summer of 1975.

Although hatch success in 1975 showed little improvement over that of 1974, there were promising signs. The number of fertile eggs per clutch was unchanged, but the number of hatched eggs per clutch increased from 8.9 to 9.6 and hatchability increased from 82.3 percent to 93.0 percent. These increases resulted in more chicks being produced from the same number of successful nests.

Also, hen kills occurred at only 1 of the 29 destroyed nests this year, a decrease from 10.3 percent to 3.4 percent. This rate of kill is much lower than the mean of 12.1 percent over the previous 12-year period.

It is hoped that these small improvements, plus the excellent brood-rearing conditions this summer, mark at least a slowing of the population decline of the past 2 years.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

September, 1975

Vol. 18, No. 9

Manipulation of Pheasant Habitat

R. E. Warner

The previous MWRL (18(8):1-3) included a report of this year's (1975) declines in pheasant nest establishment and success on the Sibley Study Area (SSA) and Ford County Management Unit (FCMU), from 1974. The reduction in nesting was exemplified by an estimated 45 percent decline in hatched nests located in roadside, small grain, hay, pasture, strip, and nonagricultural cover on the FCMU (MWRL 18(8):1).

However, information from early morning counts of pheasant broods in August 1975 reflected substantial increases in numbers of broods observed, compared with 1974. For the SSA, the increase in the number of broods observed approached 377 percent (6.3 broods per 100 miles in 1974; 30.1 in 1975, Table 1). On the FCMU, the number of broods observed increased 218 percent (17.1 per 100 miles in 1974; 54.4 in 1975, Table 1). On the FCMU, 77 percent of the hens observed were associated with broods in 1975, compared with 69 percent in 1974.

The incongruity of the declines in nesting in 1975 with the substantial increases in numbers of broods observed is clarified by the following considerations. First, it is estimated that as much as 50 percent of the 1974-to-1975 increases in numbers of broods may be attributed to extreme differences in weather conditions on the mornings when brood counts were made. Nearly every brood count morning in 1974 exhibited little or no dew. In contrast, heavy dew prevailed throughout the brood census times in 1975. From studies conducted in Iowa, differences in dewfall have been determined to be a significant factor in causing variation among brood counts. Secondly, nest searches in past years on the SSA revealed that some nesting occurred in row crops, particularly soybeans. Although row crop acreages are maximal, nest establishment and success in such cover has traditionally been assumed to be insignificant relative to other cover types. This situation may have existed in 1973 and 1974 when wet ground conditions and late planting minimized successful nesting in row crops. However, in 1975, ground cover was dry, early planting occurred, and most cultivation activities terminated in early July, when crop size prevented their continuance. Thus, any nesting in row crops in 1975 would have occurred on a reasonably dry substrate and without the interruptions of farm operations after mid-July. Therefore, extensive row crop acreages coupled with an unusually optimal season for nesting in this type of cover suggest the possibility that soybeans and corn sustained an untypically large proportion of successful pheasant nests in 1975.

Table 1. Pheasant broods observed per 100 miles early morning roadside counts on the SSA and FCMU during August, 1967-75^a.

Year	SSA	FCMU
1967	30.6	46.5
1968	19.7	66.0
1969	26.6	81.1
1970	33.4	69.4
1971	33.1	63.8
1972	21.4	47.2
1973	22.7	35.0
1974	6.3	17.1
1975	30.1	54.4

^a Data are not adjusted for mowed roadsides; brood count data in reports for 1974 were tentatively adjusted.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

In previous research letters we have reviewed the problems encountered in attempting to determine the direction and magnitude of annual changes in the statewide squirrel population (see MWRL 17, Nos. 7, 8, 9, 11, 12).

Use of midwinter squirrel counts, previous harvests, and low temperatures in spring failed to provide any consistent or significant correlations with the subsequent squirrel harvest.

The basic assumption is that the size of the squirrel harvests and the midwinter squirrel counts are annually dependent on squirrel abundance and thus are valid indices of squirrel abundance. If both indices are valid indications of squirrel abundance, then we would expect them to be correlated with each other. Failure to find significant correlation suggests that either one or both indices may not be valid for Illinois. Both the harvest estimate and the midwinter census contain serious failings and there is no way of knowing which index is the best one for use in Illinois. We have recommended that the midwinter census be discontinued because we can suggest no practical means of improving this census without greatly increasing costs. Studies have shown that time-area counts like the Illinois midwinter census have not proven to be accurate when tested against more intensive census techniques, such as livetrapping.

We have also recommended use of several techniques to improve estimates of the squirrel harvest (see MWRL 17(12):2-3). The Survey and Inventory Project, Department of Conservation, has begun to modify its procedures for sampling hunters by questionnaire, using preseason notification of hunters and repeated, color-coded mailings to induce nonrespondents to reply. In at least one year, the use of a telephone survey to reach virtually all nonrespondents should be considered so that the entire sample of selected hunters could be used to determine the squirrel harvest. If suitable means are used to sample squirrel hunters, we expect the estimate of the state-wide harvest to decline drastically, perhaps as much as a million squirrels below present harvest estimates.

Finally, we have recommended that the Survey and Inventory Project, Department of Conservation, begin to monitor tree seed crops, squirrel harvests, and sex and age ratios of squirrels on a selected sample of public hunting areas scattered throughout Illinois.

At least in extensive forests, studies have confirmed a relationship between the size of the fall seed crop, chiefly acorns (Quercus spp.) and hickory (Carya spp.) nuts, and subsequent squirrel reproduction, condition, and density. In regions with smaller forests often surrounded by agricultural crops, the effects of a mast shortage are much less severe. It was determined in Iowa and Michigan that a mast failure did not always affect subsequent squirrel harvests. Both studies concluded that the availability of agricultural crops provided squirrels with sufficient food during years of poor mast production.

In recent years, fall-plowing of harvested acreages has increased, with a resultant loss of food supplies for squirrels and other wildlife. Thus, mast failures may now be of more importance to squirrels than in past years. In 1973, there was a general mast failure over much of central and northern Illinois. In an upland oak-hickory forest in Vermilion County, located in east-central Illinois, the number of acorns and hickory nuts trapped per seed trap declined from an average of 4.2 per trap in 1972 to 1.8 in 1973. Reproduction by fox squirrels was sharply curtailed on this area in the spring of 1974. Only 33 percent of the adult females had spring litters in 1974, compared with an average of 76 percent for 1971-73. Hunters reported poor squirrel hunting in central and northern Illinois in 1974, which we attributed to the low number of juvenile squirrels available during the hunting season. It thus appears to us that knowledge of the general size of the fall mast crop is necessary to future management of the squirrel population.

The relationship of mast crops to squirrel populations can be investigated more intensively if the investigation is applied to a squirrel population of known composition. We recommend that the Department of Conservation Survey and Inventory Project (1) conduct mast surveys on selected public hunting areas each fall, and (2) collect sex and age data (paws for X rays) from shot squirrels and data on hunting pressure from the selected areas during the squirrel season.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Land acquisition and management for prairie chickens began near Bogota in Jasper County in 1962 with the purchase of 77 acres by the Prairie Chicken Foundation of Illinois. Subsequent acquisitions, mainly by the Prairie Grouse Committee of the Illinois Chapter-The Nature Conservancy, increased the acreage to 1,000 acres by 1973. Population responses at Bogota during this period were as follows: (1) continued decline for 2 years (1963-64); (2) relative stability for 3 years (1965-67); (3) encouraging increases for 5 years (1968-72); and then declines for 2 years (1973-74). The average population change and hatch success during the four periods are shown in Table 2. Thus, the four major trends in the flock at Bogota are well correlated with the success of the hatch on a sample of 513 nests found over the 12-year period. Also, a linear correlation analysis for the annual population changes versus the hatch success for the 12 years revealed a significant correlation ($r = 0.556$, $p < 0.05$).

It has become increasingly evident that success of the hatch must be at least 50 percent for a population of greater prairie chickens to remain stable. Actually, hatch success for nests found only on sanctuary land averaged 67 percent and not less than 50 percent for the 10-year period, 1963-72. The primary limiting factor acting on this population appears to have shifted from poor nest success due to spring plowing on private land and to inadequate nest habitat, 1963-68, to poor nest success due to predation on sanctuary land, 1973-75. Since the success of the hatch in 1975 was only 41 percent (MWRL 18(8):3), primarily due to mammalian predation, we cannot be optimistic about the population level at Bogota in the spring of 1976. Increasing interactions between pheasants and prairie chickens and harassment and nest parasitism by pheasants (MWRL 18(6):2-3) have recently become additional adverse factors jeopardizing efforts to preserve prairie chickens in Illinois.

Table 2. Status of prairie chicken population in relation to the fate of nests found by systematic searches, and according to reports by local residents, Bogota Study Area, 1963-74.

	1963-64	1965-67	1968-72	1973-74
Average Annual Percent Change in Population Status	-26	-4	+45	-29
Percent of Nests				
Hatched	36	48	62	36
Destroyed by plow	42	28	5	0
Destroyed by mower	8	3	1	0
Destroyed by predation	12	23	26	61
Abandoned	2	0	7	5
Number of Nests	59	40	271	143

There is a strong possibility that the results of the study will be similar to those of the previous study. The results of the study will be similar to those of the previous study.

Year	Age	Gender	Occupation	Education
1990	25	Male	Teacher	High School
1991	26	Female	Doctor	University
1992	27	Male	Engineer	University
1993	28	Female	Lawyer	University
1994	29	Male	Artist	High School
1995	30	Female	Business	University
1996	31	Male	Scientist	University
1997	32	Female	Writer	High School
1998	33	Male	Manager	University
1999	34	Female	Designer	High School
2000	35	Male	Analyst	University
2001	36	Female	Researcher	University
2002	37	Male	Developer	High School
2003	38	Female	Consultant	University
2004	39	Male	Executive	University
2005	40	Female	Professor	University
2006	41	Male	Entrepreneur	High School
2007	42	Female	Architect	University
2008	43	Male	Investor	High School
2009	44	Female	Journalist	University
2010	45	Male	Politician	High School
2011	46	Female	Activist	University
2012	47	Male	Entrepreneur	High School
2013	48	Female	Researcher	University
2014	49	Male	Developer	High School
2015	50	Female	Consultant	University
2016	51	Male	Executive	University
2017	52	Female	Professor	University
2018	53	Male	Entrepreneur	High School
2019	54	Female	Architect	University
2020	55	Male	Investor	High School
2021	56	Female	Journalist	University
2022	57	Male	Politician	High School
2023	58	Female	Activist	University
2024	59	Male	Entrepreneur	High School
2025	60	Female	Researcher	University
2026	61	Male	Developer	High School
2027	62	Female	Consultant	University
2028	63	Male	Executive	University
2029	64	Female	Professor	University
2030	65	Male	Entrepreneur	High School
2031	66	Female	Architect	University
2032	67	Male	Investor	High School
2033	68	Female	Journalist	University
2034	69	Male	Politician	High School
2035	70	Female	Activist	University
2036	71	Male	Entrepreneur	High School
2037	72	Female	Researcher	University
2038	73	Male	Developer	High School
2039	74	Female	Consultant	University
2040	75	Male	Executive	University
2041	76	Female	Professor	University
2042	77	Male	Entrepreneur	High School
2043	78	Female	Architect	University
2044	79	Male	Investor	High School
2045	80	Female	Journalist	University
2046	81	Male	Politician	High School
2047	82	Female	Activist	University
2048	83	Male	Entrepreneur	High School
2049	84	Female	Researcher	University
2050	85	Male	Developer	High School
2051	86	Female	Consultant	University
2052	87	Male	Executive	University
2053	88	Female	Professor	University
2054	89	Male	Entrepreneur	High School
2055	90	Female	Architect	University
2056	91	Male	Investor	High School
2057	92	Female	Journalist	University
2058	93	Male	Politician	High School
2059	94	Female	Activist	University
2060	95	Male	Entrepreneur	High School
2061	96	Female	Researcher	University
2062	97	Male	Developer	High School
2063	98	Female	Consultant	University
2064	99	Male	Executive	University
2065	100	Female	Professor	University

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

October, 1975

Vol. 18, No. 10

Manipulation of Pheasant Habitat

R. E. Warner

Hunter success during the opening weekend of the hunting season in 1975 is expected to be greater than in 1974. As reported in September (MWRL 18(9), Table 1), the numbers of broods observed per 100 miles of driving in August 1975 revealed substantial increases over the numbers of broods observed in 1974 for both the Sibley Study Area (SSA) and the Ford County Management Unit (FCMU).

Hunter success during the opening weekend may be additionally improved by enhanced accessibility to birds as row crops harvesting and fall plowing approach an early completion, thus concentrating birds in permanent cover and occasional unharvested corn and soybean fields. On the SSA and FCMU, almost 90 percent of the soybean harvest and approximately 50 percent of the corn harvest had been completed by 14 October 1975. Weather permitting, a larger than average proportion of row crop fields will be harvested and plowed by the onset of the pheasant season on 8 November.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Even-aged timber management featuring clear-cutting followed by one or more intermediate or selective timber cuts is now an accepted management practice throughout the hardwood forests of the Midwest.

Clear-cutting is not yet extensively used by the service forester on private forests in Illinois, but the U. S. Forest Service and the industrial forest owners are using clear-cuts to regenerate their forests.

Nothing is known as to the specific effects of clear-cutting on squirrels. However, it is known that complete tree removal will also remove the squirrel population. Do the squirrels located in clear-cuts simply shift their home ranges to the uncut peripheries or do they disperse or die? How can clear-cuts be modified so as to minimize their adverse effects on squirrels? Will islands of trees left uncut in clear-cuts help to lessen the impact of clear-cuts on the squirrel populations?

We began a study in 1968 to answer these and other questions regarding the effects of clear-cutting on gray squirrels. This study, a cooperative effort of the Ohio Division of Wildlife, Illinois Department of Conservation,

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and the Illinois Natural History Survey, has now been completed. The objectives of the study were: (1) to determine the immediate (1-3 years postcut) effects of clear-cutting on squirrel densities, movement, survival, reproduction, and condition; (2) to determine the value to squirrels of small (0.5-1.0 acre) uncut islands of trees left in clear-cuts; (3) to determine gray squirrel utilization of clear-cuts at 1, 2, 7, 15, and 20 years postcutting; (4) to determine gray squirrel food production in clear-cuts 1, 2, 7, 15, and 20 years old; and (5) to determine the utilization by gray squirrels of nest boxes placed in clear-cuts 20 and 35 years old.

We will report the results of this study in subsequent research letters.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

As previously reported (MWRL 18(8):6), nest success on the sanctuaries at Bogota this year was only 41.4 percent--the third consecutive year that nest success was below 50 percent. This low rate of success was attributed to increased predation on nests, possibly as a result of a reduced food base for predators.

For the past 3 years, when overall nest success was low, a few sanctuaries have maintained a high rate of nest success. These sanctuaries (Marks, J. McCormack, Fuson, Otis, and Galbreath) were all on the periphery of the sanctuary complex and supported lower densities of prairie chickens than those sanctuaries in the core of the area (Yeatter, Field, McGraw, Donnelley, and C. McCormick). During 1973-75, 190 (32.1 percent) of the nests on sanctuaries in the core of the area hatched. During the same period, 11 of the 17 nests (64.7 percent) found on the outlying sanctuaries hatched. Apparently, nest predation on prairie chicken nests increases as nest density increases. However, densities of other prey species must also be considered. In 1972, the nest density of prairie chickens was the highest ever recorded on the sanctuaries, yet nest success was 64.9 percent. But small mammals and ground-nesting birds were also plentiful.

Our sanctuaries may be providing "islands" of habitat that support high numbers of prey species, thus attracting significant numbers of predators. As prairie chickens increase on individual sanctuaries, we may expect increased rates of nest predation. Especially high rates would be expected in years when prairie chickens maintain their numbers while other prey species decline.

MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

November, 1975

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Manipulation of Pheasant Habitat

R. E. Warner

Hunting pressure on the Sibley Study Area (SSA) and the Ford County Management Unit (FCMU) was light during the opening weekend (8-9 November 1975) of the pheasant hunting season. Favorable weather conditions prevailed during the 2 days and fields were moderately dry. The soybean harvest, 95 percent of the corn harvest, and 80 percent of the fall plowing had been completed.

Hunter success on the SSA during the opening weekend this year was the poorest in 14 years. The 61 hunters interviewed hunted 329 man-hours and killed 20 pheasants (16.5 hours per bird). The number of hours in the field required to kill a pheasant in 1962 through 1974 was 2.2, 2.7, 2.1, 8.0, 6.9, 8.1, 5.0, 4.3, 4.7, 3.4, 6.2, 7.4, and 8.3, respectively.

On the FCMU, the 60 hunters interviewed during the opening weekend tallied 272 man-hours and killed 58 pheasants (4.7 hours per bird in 1975, 3.1 hours per bird in 1974).

Field time required to bag a pheasant on the SSA in 1975 was 3.5 times as great as that required by hunters on the FCMU (16.5 hours per bird on the SSA, 4.7 hours on the FCMU). Although effort per bird was greater in 1975 than in 1974 for both study areas, man-hours per bird increased only 52 percent on the FCMU (4.7 hours in 1975, 3.1 hours in 1974) compared with a 99 percent increase on the SSA (16.5 hours in 1975, 8.3 hours in 1974).

Although pheasants were more abundant than in 1974 (MWRL 18(9):1), the hunter kill information for 1975 does not reflect this increase, most likely because of the unusually advanced fall plowing. Birds were concentrated in permanent cover for the first few hours of opening weekend; thus, hunters having initial access to such cover had considerable success. The scattering of birds into plowed fields as opening day progressed made them much less accessible to hunters. Had more stubble remained unplowed, birds would have been more readily approachable, and hunter success might have been substantially improved.

Ecology and Management of SquirrelsC. M. Nixon,
S. P. Havera

One objective of our study of clear-cutting was to determine the immediate (1-3 years postcut) effects of clear-cutting on gray squirrel survival, movement, condition, reproduction, and density.

We used two study areas for this aspect of our investigation: the 206-acre Truetown Area with a 35-acre clear-cut and the 188-acre Doanville Area containing two clear-cuts, one of 19.5 acres and the other of 9.5 acres. On both areas we livetrapped and tagged squirrels for 2 years before timber cutting began and continued to livetrapped for 2 years after cutting. Livetraps were placed 60 meters apart throughout both study areas.

At Truetown, the late-summer gray squirrel population on the entire 206 acres declined 43.3 percent from 193 squirrels to 109 squirrels (estimated numbers) immediately after clear-cutting the 35 acres. The second year after cutting, it was estimated that squirrel numbers increased to 140 adult and sub-adult squirrels. The decline in density at Truetown was mostly due to a drastic decline in captures of subadults after 1968.

Before cutting, subadults comprised 53.3 percent of all captures ($N = 197$), but after cutting, subadults made up only 20.2 percent of the captured population. We believe this significant decline ($P < 0.05$) in subadults captured was not entirely due to the clear-cut. Survival of young and fecundity of breeding females was extremely high in 1968 throughout southeast Ohio as squirrels recovered from a catastrophic mast failure that occurred 2 years before. However, we do believe that the loss of the most prolific producer of cavities suitable for rearing young contributed to the observed decline in subadult captures after clear-cutting. The cut destroyed hundreds of old-growth American beech that contained an average of 5.7 nest dens per acre. In contrast, the uncut area contained only 0.8 den per acre.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

The new cash-bid approach to management was implemented in 1975 on the state-owned prairie chicken sanctuaries, which include 567 acres or 36 percent of the total sanctuary acreage. A major advantage to the cash-bid procedure is that many of the routine chores of the sanctuary manager are eliminated--such as procurement of elevator receipts, weight tickets, and fertilizer bills--with which to document the state's share of crop yields, income, and expenses. Also, because the bids cover a 2-year period, rewriting of leases and repeated contacts with farmers are held to a minimum.

The disadvantages in managing the state-owned sanctuaries under the cash-bid procedure are as follows:

1. The taxable acreage (acres harvested or grazed) for each farmer must be reported annually to the County Supervisor of Assessments and then be checked to make sure the farmers are assessed correctly.

2. The fees, based on the acres harvested and the cash-bid rate, must be collected from each farmer prior to 1 December and sent to Springfield with an explanatory letter.

3. The lessees are reluctant to read the lease agreements. They must be reminded several times of their obligations. Some are mainly interested in the soybean acreage involved in the lease and care little about the grassland management involved. Grass seedings may be carelessly done. None of the new seedings made in the spring of 1975 were mowed for weed control as was specified in the leases.

4. The harvest of redtop grass seed is still our major management operation. In 1975, six factors coincided to limit the acreage harvested for grass seed: (1) a low market price for redtop seed, (2) a poor yield because of drought in June, (3) high winds and heavy rain at the onset of the harvest so that much of the seed shattered, (4) high humidity during harvest, (5) previously set cash bids that were too high in some cases, and (6) the obligation to pay taxes on the acreage harvested. Thus, a large acreage of redtop was left unmowed and subject to lodging, a condition generally unsuitable for nesting prairie chickens. Lack of mowing also promotes the development and spread of undesirable rank stands of weeds and the invasion of woody plants. On sanctuaries owned by The Nature Conservancy we were free to give tenants a larger share (in some cases all) of the crop, to obtain better management for prairie chickens.

5. Treatment with limestone and other expenses requires approval of field requisitions, and competitive bids are required for expenditures over \$200. This procedure is cumbersome, time consuming, and inefficient. By the time approval is gained and successful bidders determined, it is often too late to make the expenditure. Purchases also require invoice vouchers (seven copies) and receiving reports (three copies).

Thus, in the management of the sanctuaries, the disadvantages of state ownership and cash-bid management far outweigh the advantages. We have recommended that The Nature Conservancy propose that the state lease its sanctuaries to The Nature Conservancy. The problems attending the management of sanctuaries owned or leased by The Nature Conservancy are fewer and appear simpler to solve than those presented by state ownership and cash-bid management.

JAN 16 1976

MONTHLY WILDLIFE RESEARCH LETTER

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Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

December, 1975

Vol. 18, No. 12

Manipulation of Pheasant Habitat

R. E. Warner

A computer model program design is being synthesized to facilitate expansion of the seeded-roadside concept throughout east-central Illinois in order to insure that future block roadside seedings will offer maximum potential for enhancing local pheasant numbers. Presently, a model for selection of townships is envisioned for Ford, Iroquois, Livingston, Champaign, and McLean counties. Three primary components comprise the model: (1) relative pheasant abundance, (2) roadside width and suitability for seeding, and (3) land use.

Relative pheasant abundance has been indexed and ranked by township, according to the Illinois Rural Mail Carrier Census of 1973. Roadside characteristics will be extracted from data collected by John C. Cole in 1972 for his Master of Science thesis. A computer program is being developed that will estimate, for each township, roadside width and suitability for seeding.

Land-use statistics have been extracted from the "Illinois Annual Farm Census Township Summaries" for 1961 through 1972 (latest available year of statistics). A computer program has been constructed to calculate for each township the percentages of acreage in row crops, hay, harvested small grains, and other farmland. In the next MWRL, the determination of land-use parameters for selecting townships for block seeding will be discussed. In addition, the characteristics of three townships suggested for future block roadside seedings will be presented.

Ecology and Management of SquirrelsC. M. Nixon,
S. P. Havera

Clear-cutting 35 acres of the 206-acre Truetown Study Area had an immediate and adverse effect on the resident gray squirrels. Livetrapping captures in the 35-acre clear-cut declined from 27.4 percent of the total number of captures on the entire 206 acres (32 of 117) before cutting to 1.8 percent of the total number of captures (1 of 55) after clear-cutting.

Recovery rates for tagged gray squirrels whose pre-cut home ranges included all or part of the clear-cut were lower than recovery rates for squirrels whose pre-cut home ranges did not include the clear-cut. Significantly fewer ($P < 0.10$) adult males exposed to the clear-cut (2 of 17, 11.8 percent) were recovered after cutting compared with adult males (11 of 38, 28.9 percent) in the uncut portion of the study area. Both males that survived the clear-cut shifted their home ranges away from it.

THE UNIVERSITY OF CHICAGO

DEPARTMENT OF THE HISTORY OF ARTS AND ARCHITECTURE

OFFICE OF THE DEAN OF THE FACULTY

CHICAGO, ILL.

SEPTEMBER 11, 1957

Dear Sir:

Enclosed for you are two copies of a letterhead memorandum

dated September 10, 1957, from the Dean of the Faculty, which sets forth the University's policy regarding the appointment of new faculty members. This memorandum is being distributed to all members of the Faculty for their information and guidance. It is hoped that this will help to clarify the University's position on this matter and to ensure that all appointments are made in accordance with the established policy.

Very truly yours,
Dean of the Faculty

Enclosed for you are also two copies of a letterhead memorandum dated September 10, 1957, from the Dean of the Faculty, which sets forth the University's policy regarding the appointment of new faculty members. This memorandum is being distributed to all members of the Faculty for their information and guidance. It is hoped that this will help to clarify the University's position on this matter and to ensure that all appointments are made in accordance with the established policy.

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Only one female affected by the clear-cut was recovered after cutting (1 of 13, 7.7 percent), and she shifted her home range away from the clear-cut area. In the uncut forest, 15.4 percent of the adult females (6 of 39) were recovered during the same time period.

We were unable to tag many juvenile gray squirrels in or adjacent to the clear-cut the year before clear-cutting. The only juvenile male tagged in the area to be clear-cut disappeared after clear-cutting. However, three of seven juvenile females survived the clear-cutting and established themselves in new home ranges.

Recovery rates for all squirrels, whether affected by the clear-cut or not, were not high at Truetown. An unknown but significant amount of squirrel hunting took place each year during the study and undoubtedly removed many tagged squirrels.

There were two clear-cuts on the 188-acre Doanville Area, one 19.5 acres, the other 9.5 acres. Squirrel densities on the entire 188-acre Doanville Area remained essentially stable after cutting, declining only 5 percent. The sex and age composition of livetrapped samples taken in August for 2 years prior to cutting and for 2 years after cutting also did not materially change after clear-cutting. However, as at Truetown, squirrels avoided the clear-cuts at Doanville. Livetrapped captures of squirrels with portions of the ranges in one or the other of the two clear-cuts made up 36.4 percent (20 of 55) of the total number of captures before cutting but only 3.2 percent (2 of 63) after cutting.

Recovery rates were not significantly affected by clear-cutting at Doanville. Fifty percent (7 of 14) of the adult males whose ranges included a clear-cut were recovered after the cutting. The percentage of recoveries for males not affected by clear-cutting was 62.5 (5 of 8). This difference was not significant ($P > 0.05$).

Survival of adult females whose home ranges included one or both clear-cuts was higher (7 of 11, 63.6 percent recovered) than that of females whose home ranges did not include a clear-cut (4 of 10, 40.0 percent recovered). Four of the seven females recovered after clear-cutting remained in their pre-cut home ranges; the other three females shifted their home ranges away from a clear-cut.

At Doanville, as at Truetown, survival of subadult squirrels was low whether or not their home ranges included a clear-cut.

The 35-acre clear-cut (Truetown) was much more detrimental to squirrels than the clear-cuts of 9.5 and 19.5 acres. Survival of resident adult squirrels was not affected by the two smaller clear-cuts.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

To date, 18 acquisitions totaling 1,561 acres (1,001 in Jasper County, 560 in Marion County) are being managed for prairie chickens by the Natural History

Page 10 of 10
10/10/10

The following information was obtained from the records of the Department of the Interior, Bureau of Land Management, for the period 1900 to 1910.

The following information was obtained from the records of the Department of the Interior, Bureau of Land Management, for the period 1910 to 1920.

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The following information was obtained from the records of the Department of the Interior, Bureau of Land Management, for the period 1980 to 1990.

The following information was obtained from the records of the Department of the Interior, Bureau of Land Management, for the period 1990 to 2000.

Survey. It is becoming more difficult each year to complete the goal of 1,500 acres in each county due to (1) the scarcity of suitable land for sale and (2) the dramatic increase in the market value of land in recent years. The present sanctuary acreage was purchased at an average price of \$370.59 per acre. Per-acre prices ranged from \$225.00 in 1962 to \$800.00 in 1974. By contrast, some recent public auctions of land comparable to much of the present sanctuaries resulted in sales as high as \$2,450.00 per acre in Jasper County. Increasing prices of this magnitude diminish the likelihood that our goal in acquiring land can be accomplished, especially when funding depends on donations. Therefore, each tract in the present sanctuary system must be developed to its fullest potential for nesting prairie chickens.

Unfortunately, nearly 10 percent (143 acres) of the present sanctuary land is useless to prairie chickens, mainly because of the presence of woods and brush. Woodland and brush dominate the Galbreath 110-acre sanctuary and portions of two other tracts (Fuson and Walters) at Bogota either by solid stands or by the hemming-in effect of woody cover in fencerows or dendritic draws.

In addition, about 20 percent of the total sanctuary acreage is used annually for the necessary rotation of soybeans, small grains, and new seedings on sanctuary grasslands and thus does not produce nest cover. This rotation is limited to redtop-timothy meadows, which decline in vigor and become invaded with weeds and woody vegetation. Plowing, row-cropping, and reseeding provide suitable sites for booming grounds in strategic locations on the larger sanctuaries; however, the provision for booming grounds need not comprise more than 8 percent of the total sanctuary acreage annually.

Through prairie restoration it is theoretically possible to maintain a larger proportion of the sanctuary acreage in nest cover than with the present system, which is based largely on redtop-timothy management. Excellent densities of nests and good nest success have been well documented by our annual nest study in these cover types; however, because of problems associated with redtop and timothy management (MWRL 17(8):2-3 and 18(11):3) we should not depend wholly on these domestic species of grass. Some degree of prairie restoration has been accomplished on 178 acres. We must now learn the best means of managing prairie vegetation for the maximum benefit of nesting hens. About 50 acres of prairie vegetation are now sufficiently established to make management by hay harvest feasible. During the summer of 1975, five fields totaling 42 acres of native grasses were mowed for hay during late July and early August. The regrowth after haying was impressive in the five plots, and in 1976 they will provide the first significant opportunity to test this cover type as nest cover.

Thus, it is hoped that by (1) continuing our efforts at prairie restoration, (2) demonstrating its acceptance by both prairie chickens (for nesting) and local farmers (for hay and perhaps pasture), and (3) minimizing the acreage of woodland and brush, we can increase the productive capacity of the present sanctuary acreage for prairie chickens. Nest cover may ultimately encompass up to 92 percent of the sanctuary acreage on an annual basis instead of the 60 to 70 percent maintained under the current management program.

Page 10

and the fact that the Commission has not yet received any information from the Government of the United States regarding the activities of the Committee for the Liberation of the Americas, the Commission is of the opinion that the Committee is still active and is working to achieve its objectives. The Commission is of the opinion that the Committee is still active and is working to achieve its objectives. The Commission is of the opinion that the Committee is still active and is working to achieve its objectives.

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MONTHLY WILDLIFE RESEARCH LETTER

Department of Conservation and Natural History Survey, Cooperating

NATURAL HISTORY SURV

Glen C. Sanderson and Helen C. Schultz, Editors

B 4 1976

Urbana, Illinois

January, 1976

Vol. 19, No. 1

LIBRARY

Manipulation of Pheasant Habitat

R. E. Warner

Last month's research letter (MWRL 18(12):1) disclosed that a computer program has been designed to calculate, by township, the percentage of acreages in row crops, hay, harvested small grains, and other farmland. In order to select townships for future seedings, minimal and maximal standards of acceptability were determined for each cover type. These parameters were derived from land-use patterns on the Ford County Management Unit (FCMU) and on the surrounding Peach Orchard Township area, Ford County, in 1973 and 1974.

Field studies on the FCMU revealed extensive use of seeded roadsides by nesting pheasants in 1973 and 1974. Thus, acceptable parameters of land-use patterns for selecting locations for future block seedings that are most likely to be effective in enhancing local pheasant populations are presently being ascertained from land use on the FCMU in 1973 and 1974.

Three townships have been selected for locations of future block seedings: Harwood (Champaign County), Prairie Green (Iroquois County), and Anchor (McLean County). Harwood and Prairie Green townships were selected because land-use practices were within standards determined from the FCMU and because relative pheasant numbers were high (Table 1). However, Anchor Township was selected in order to study the effect of a block seeding on local pheasant numbers where row crop farming is more extensive than in areas presently monitored for pheasant numbers. Also, Anchor Township's close proximity to the Sibley Study Area (SSA) will allow the utilization of the SSA as a control area. Land-use practices for each selected township are shown in Table 1.

Table 1. Land use for selected townships, calculated from crop reporting service data for 1972.

Township	County	Percent of Acreage					Pheasant Index _C
		Row Crops	Harvested Hay	Small Grains	Hay + Pasture + Small Grains	Other Farmland	
Sullivan ^a	Ford	76.1	2.07	0.88	7.11	16.8	40.46
Peach Orchard ^b	Ford	76.6	2.63	2.02	6.48	16.9	48.68
Anchor ^d	McLean	84.8	1.17	0.93	3.10	12.1	16.30
Harwood ^d	Champaign	73.5	1.29	3.05	6.59	19.9	31.32
Prairie Green ^d	Iroquois	77.9	1.69	5.56	9.50	12.6	41.85

- a Location of Sibley Study Area.
- b Location of Ford County Management Area.
- c Index from Rural Mail Carrier Census of 1973.
- d Townships selected for block seedings in 1976.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Clear-cutting 35 acres of the 206-acre Truetown Study Area did not affect the body weights of the surviving squirrels. In fact, weights increased after cutting for both male and female gray squirrels.

The clear-cut did affect the mean distance traveled between recaptures at Truetown. A comparison between the mean distance traveled by adult male gray squirrels the year prior to cutting (1970 - $\bar{X} = 147.9$ meters, $N = 54$) with the mean distance traveled by adult males the year after cutting (1972 - $\bar{X} = 220.2$ meters, $N = 19$) showed a significant increase in movement ($P < 0.02$). Female gray squirrels also increased their movement after the clear-cut was complete, although not significantly ($P > 0.05$). We assume that the clear-cut created a barrier for those squirrels adjacent to the cut area and that the squirrels were forced to move somewhat greater distances to satisfy their needs.

At Doanville, with clear-cuts of 9.5 and 19.5 acres, there was no significant difference in body weight or in the mean distance moved before and after clear-cutting.

Clear-cutting virtually eliminates tree seed crops and thus drastically reduces the supply of foods for gray squirrels. At Truetown, production of squirrel foods declined 99 percent (by weight) from pre-cut levels both 1 and 2 years after cutting. Only gill fungi, flowering dogwood (Cornus florida) and grapes (Vitis spp.) were produced in the clear-cut. With all denning sites destroyed and a much reduced food base, squirrels have little incentive to penetrate far into a recent clear-cut.

At both Doanville and Truetown, gray squirrels penetrated less than 40 meters into the clear-cuts during the spring and summer months. Squirrels may also be hesitant to enter clear-cuts after leaf-out because the dense vegetation and old logging debris make it difficult for them to avoid predators. However, in winter, after leaf fall, squirrels penetrate into clear-cuts considerable distances. At Truetown, in January, squirrels were penetrating nearly to the center of the cut (center = 192 meters from the uncut forest). At Doanville, squirrels were crossing entirely through both clear-cuts (distances up to 120 meters). Squirrels can more easily avoid predators in a clear-cut in winter, and the approaching breeding season often causes squirrels, particularly adult males, to increase their travels.

Thus, squirrels make little use of clear-cuts the first 2 years after cutting. Juvenile squirrels whose pre-cut home ranges include areas that are subsequently clear-cut usually disperse or die; they do not usually move to adjacent uncut stands. Adults that have large portions of their home ranges affected by clear-cuts usually disappear, presumably to disperse or die; they do not displace the squirrels that live adjacent to the clear-cut areas. Adult squirrels with less than half of their home range affected by clear-cuts usually shift their activities into the uncut portions of their pre-cut home ranges. Penetration of the clear-cuts by squirrels may represent the squirrels' reluctance to abandon totally previously established home ranges despite the extreme physical alteration of the sites by clear-cutting.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

The old adage among ecologists, "Nothing succeeds like succession," is particularly appropriate in the prairie-forest transition zone of southern Illinois. Invasion of grasslands on prairie chicken sanctuaries by woody vegetation can be serious in as little as 3 years after land acquisition, cessation of row cropping, and seeding with a grass-legume mixture. In most instances, the speed of invasion by woody plants depends on the proximity of seed sources. One of the most rapid shrub invaders in our grasslands is multiflora rose (Rosa multiflora). Rapid tree invaders include ash (Fraxinus spp.), maple (Acer spp.), and cottonwood (Populus deltoides), which have seeds that are readily disseminated by wind. Other problem species include mulberry (Morus spp.), honey locust (Gleditsia triacanthos), hawthorn (Crataegus spp.), Japanese honeysuckle (Lonicera japonica), and trumpet creeper (Campsis radicans). Desirable woody species include wild black cherry (Prunus serotina), oaks (Quercus spp.), dogwood (Cornus racemosa), and dewberry (Rubus flagellaris), but even these species should be limited to scattered trees, clones, or patches on prairie chicken sanctuaries. Some of the above species have shortened the longevity of redtop meadows on sanctuaries from an average of about 8 years to 4 or 5 years. Invaded fields can be remedied most expeditiously by plowing, cropping 1-2 years with soybeans plus herbicides, and then reseeded to nest cover. However, such short rotations on the limited sanctuary acreage reduce the amount of nest cover available on an annual basis. Our goal must be to maximize the available nest cover on an annual basis from about 65 percent of the sanctuary acreage under the current management program to about 90 percent, as explained in the last newsletter (MWRL 18(12):2-3).

Some fields are not suitable for control of succession by plowing and reseeded. Such areas include steep slopes and fields in which prairie restoration is under way. About 143 acres of sanctuary land were useless to prairie chickens at the time of acquisition and, for the most part, are still useless as nest-brood habitat because of the presence of woodland and brush. Other sanctuaries, though free of solid stands of woody cover, are surrounded by wooded fencerows or are intersected by dendritic draws. Linear distributions

of woody cover threaten nearby open meadows with a close seed source and a hemming-in effect.

Fire can be a useful tool in retarding succession in areas where periodic plowing and cropping is not warranted or is impossible. However, fire alone will not control succession adequately in many situations. Fuel supplies under large trees or on soils of low fertility may be inadequate to obtain fires of sufficient intensity to kill woody growth. Where fuel supplies are adequate to kill top growth, continual resprouting perpetuates the problem. However, periodic fire promotes the development of fire-tolerant prairie flora and thereby gradually increases fuel supplies for subsequent burns.

Control of woody invasion by mowing with a heavy-duty rotary cutter is sometimes desirable, but, because of the resprouting problem, mowing is ineffective, costly, and too consumptive of energy in the long run. Also, heavy thorn growth on honey locust, hawthorn, and multiflora rose causes frequent flat-tire problems. Large trees may be felled or at least girdled by chain saw or axe, but resprouting may then become a problem with stumps or with the bases of girdled trees.

The judicious use of chemical control appears to offer the most efficient and effective means of controlling succession of woody plants, especially when used in conjunction with fire, physical methods, and prairie restoration. One of the most promising chemicals in terms of effectiveness, efficiency, selectivity, and ease of handling appears to be picloram. Picloram (TORDON 10K) is sold in a dry pelletized formulation of 10 percent 4-amino-3, 5, 6-trichloropicolinic acid. Toxicological studies indicate that picloram has low dermal toxicity and very low toxicity to fish, birds, mammals, and soil microorganisms. Picloram can be applied by hand (perhaps in conjunction with our annual nest search), a pinch at a time, at the base of individual stems or suckers or unwanted woody vegetation. The pellets are then activated by rain soaking the chemical into the root zone. Picloram has been successfully used in the Great Lakes states in maintaining openings in forests for wildlife. We see no reason why such a chemical cannot be used in our situation to help gain maximum utilization of our limited sanctuary acreage by prairie chickens.

MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

February, 1976

Vol. 19, No. 2

Manipulation of Pheasant Habitat

R. E. Warner

Roadside widths in the Ford County Management Unit (FCMU) were measured in 1968, prior to the initiation of seeding operations on the roadsides. In 1973 and subsequently during January 1976, widths of the roadsides on the 68 plots that were randomly selected for nest studies were measured.

Comparative results of the width measurements for 1968, 1973, and 1976 are listed in Table 1. Among the 3 years, there is no significant change in roadside acreage per mile ($P > 0.05$). A slight increase (8.9 percent) in roadside width, noted from 1968 to 1973, may have occurred in response to the managed roadside program. This explanation is supported by the fact that most roadsides that increased in width have been controlled by farm operators in strong agreement with the seeded roadside program. The slight decline in roadside width (2.8 percent) that occurred from 1973 to 1976 would be expected on the basis of current intensive farming practices in east-central Illinois. In fact, over the past 3 years roadsides throughout east-central Illinois may have declined at a rate greater than 2.8 percent. Thus, future studies will include a comparison of changes in roadside widths on seeded and unseeded roadsides on representative areas in east-central Illinois.

Table 1. Average area of 68 randomly selected roadside plots on the FCMU.

Year	1968	1973	1976
Average width (feet)	16.9	18.8 ^a	17.9
Total acres	39.5	43.0	41.8
Percent change	----	(+)8.9	(-)2.8
Acres per mile	2.1	2.2	2.2

^a Roadside characteristics were surveyed for counties in east-central Illinois by John C. Cole in 1972. It was determined that the width of cover along similar types of roads in Ford County (all townships) averaged 20.8 feet.

UNIT 1: THE HISTORY OF THE UNITED STATES

LESSON 1: THE FOUNDING FATHERS

THE FOUNDING FATHERS WERE THE LEADERS OF THE AMERICAN REVOLUTION AND THE FIRST PRESIDENTS OF THE UNITED STATES.

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Ecology and Management of SquirrelsC. M. Nixon,
S. P. Havera

Seven years after clear-cutting, the developing stand in a clear-cut area is a mixture of vines, trees, and shrub species 4-6 meters high. We studied gray squirrel utilization and squirrel food production for 2 years, 1973-75, in a 5.8-acre 7-year-old clear-cut.

Only two individual squirrels were captured in the 7-year clear-cut during 2 years of livetrapping, both of which were 1 year or less in age. The first year live traps were operated throughout the clear-cut, and all captures were made less than 28 meters from the forest edge. The second year we closed all the traps in the outer perimeter to see if squirrels were foraging into the interior of the clear-cut. During November a squirrel was taken 56 meters from the edge, nearly in the center of the clear-cut (the center of the cut was 66 meters from the edge).

Squirrel track counts on snow during two winters revealed that squirrels were penetrating less than 45 meters into the clear-cut.

Production of squirrel foods was significantly higher in the 7-year cut compared with the 1- or 2-year clear-cuts at Danville and Truetown. However, most of this production consisted of perishable summer foods, principally blackberries. Small amounts of gill mushrooms and flowering dogwood were also found, but there were no foods suitable for fall and winter storage.

There were no leaf nests built in the 7-year clear-cut and, of course, no den cavities suitable for nesting.

Thus, for 7 years and probably 10 years after clear-cutting, squirrels living in the uncut forest surrounding the clear-cut utilize only the perimeter of the clear-cut for limited foraging during the summer months, rarely penetrating beyond about 30 meters from the uncut edge. In winter, squirrels penetrate deeper into the cut, but with no shelter or food available they do not remain very long.

It seems likely that during the first 10 years after cutting, squirrels rarely penetrate to the center of clear-cuts wider than 70 meters.

Responses of Prairie Chickens to Habitat ManipulationR. L. Westemeier,
D. R. Vance

As reported in MWRL 18(6):2, we are in a position to document interactions between prairie chickens and pheasants on the Bogota Study Area. The interaction most often observed is the aggressive harassment of prairie chickens on booming grounds by cock pheasants. Although such aggressive behavior has been observed during every month that prairie chickens occupy the booming grounds (late September to June), most harassment apparently occurs in March

and April. These 2 months cover the peak booming and breeding season of prairie chickens in Illinois and also the initiation of crowing territories by cock pheasants.

During March and April 1970-75, observers spent 394 blind-mornings on booming grounds. Pheasants were observed on the grounds on 68 separate occasions. No pheasants were seen on booming grounds prior to 1970. On 31 (46 percent) of the 68 occasions, some interspecies conflict was noted. In 25 (81 percent) of the 31 encounters between cock pheasants and prairie chickens, the pheasant dominated one or more prairie chickens. Aggressive behavior by cock pheasants was variable. The range of aggression from mild to severe was as follows:

1. Confrontation and brief chasing of one or two prairie chicken cocks on the periphery of a booming ground.
2. Repeated chasing of a single prairie chicken cock until the prairie chicken leaves the booming ground in flight.
3. Chasing a single prairie chicken cock off the booming ground and pursuing the chicken in flight.
4. As in 3 above, but returning to repeat the performance with additional chickens.
5. Dominance of entire booming ground, including the dominant prairie chicken cocks, with some or all chickens leaving the ground.
6. Dominance of entire booming ground, followed by active courtship display before a prairie chicken hen.

In every case, a single cock pheasant was responsible for all harassment.

On the six occasions that prairie chickens proved dominant over a pheasant, the pheasant initiated the conflict with a dominant prairie chicken cock and was chased to the edge of the booming ground by two or more prairie chicken cocks. At no time did prairie chickens pursue pheasants off the booming ground.

Evaluating the impact of this harassment by cock pheasants is difficult. However, no benefit to prairie chickens is apparent. Conceivably, such aggression, especially when it involves dominant prairie chicken cocks, could delay or even prevent successful breeding by prairie chickens on a particular booming ground. At its worst, aggressive behavior by pheasants could result in sterile hybrid offspring, thus reducing the reproductive potential of the largest remnant flock of prairie chickens in Illinois. Pheasant X prairie chicken hybrids have been reported in other states. Considering these possible consequences and the recent population declines at Bogota, we advocate the removal of as many aggressive cock pheasants as possible on prairie chicken sanctuaries.

Urbana, Illinois

March, 1976

Vol. 19, No. 3

Manipulation of Pheasant Habitat

R. E. Warner

Success of the IDC's seeded roadside program is dependent upon the extent to which farmer cooperators adhere to the agreed delayed mowing date of 31 July. One of the purposes of establishing the Ford County Management Unit (FCMU) was to determine the acceptance of the seeded roadsides by farm operators by monitoring their adherence to the delayed mowing schedule.

Agreements were reached with farmers on the FCMU prior to roadside seeding in the fall of 1968. Cooperators were notified by letter that spraying and reseeding would be done as needed during 1969, that signs informing the public about the seedings would be placed on each road entering the 16-square-mile area, and that mowing operations should be delayed through 31 July of each year. Subsequently, letters in 1969, 1970, and 1971 informed farmers of progress in reseeding and of cooperation in delayed mowing, and reminded them that roadsides should not be mowed until 31 July in future years. The final letter (May 1971) stated that no letter of reminder would be forthcoming in 1972.

Results of delayed mowing along the 73 cooperator-miles of roadsides in the FCMU were as follows: 72 percent unmowed as of 31 July 1970, 81 percent in 1971, 78 percent in 1973, and 87 percent in 1974. A general decrease in the percentage of roadsides mowed prior to 31 July occurred through 1974, but delayed mowing of roadsides in 1975 declined to 63 percent.

Because farmer cooperation is important to the success of the roadside program, farmers on the FCMU were interviewed during January 1976. Each farmer was contacted personally or by telephone. The purpose of the interviews was threefold; (1) to determine the extent of the farmers' recollections of their agreement in 1968 to participate in the seeded roadside program, (2) to measure the present attitudes of the farmers toward the program, and (3) to encourage future participation in the program in accordance with the terms of the 1968 agreement. Results of the farmer interviews will be reported in next month's research letter.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Fifteen years after clear-cutting, the developing stand is considerably less dense than after 7 years, particularly for good sites. Trees range from

8 to 12 meters high, blackberry vines are dying out, and visibility in the understory has improved.

We studied squirrel utilization and squirrel food production on two 15-year clear-cuts, a 5.2-acre cut on a medium site and a 5.5-acre cut on a good site.

Eight individual squirrels were captured in the 15-year good site; two were taken in April, two in July, and four in November. The captures included three adult males, one adult female, two yearling males, one juvenile male, and one juvenile female.

These squirrels penetrated a significantly greater distance into the 15-year clear-cut compared with squirrels in the 7-year cut (34.3 meters in the 15-year cut, 19.3 meters in the 7-year cut; $P < 0.05$). During the second year of trapping, the traps on the perimeter of the cut were closed but no squirrels were captured in the center of the clear-cut during April, July, or November. Snow track counts showed that, in winter, squirrels were penetrating to the center of the clear-cut (center = 92 meters from the edge); tracks were found in all portions of the clear-cut.

Seven squirrels were captured in the 15-year 5.2-acre medium cut, six in May and three of these same squirrels plus one new squirrel in July. Only one squirrel was captured in November. The captures in this clear-cut included one adult male, one adult female, three juvenile females, and two juvenile males.

The mean distance penetrated at capture was 35.5 meters, nearly identical to the mean capture distance (34.3 meters) for the 15-year good site. When the traps on the perimeter of the cut were closed, 10 captures of squirrels were made in the interior of the cut at a mean distance of 55 meters from the forest edge (center of the cut = 94 meters from the edge). In winter, squirrels were penetrating to all portions of the clear-cut.

Squirrel food production was low in both the good and medium sites at 15 years. There was significantly less ($P < 0.001$) food available in the 15-year cuts compared with the 7-year clear-cut, chiefly because of a lack of blackberry production in the 15-year cuts. Gill fungi and flowering dogwood were the only consistent food producers on both sites. On the medium site, one chestnut oak produced a few acorns at age 16 years.

A few leaf nests were found on both 15-year clear-cuts. These nests were of summer construction and were not used as winter shelters.

Squirrel use of 15-year clear-cuts increased greatly compared with utilization of 7-year clear-cuts, but squirrels were still unable to find suitable food for storage or to find permanent shelter. Although developing stands provide squirrels with more escape cover than younger cuts and also with improved visibility for sighting predators, utilization of these stands by squirrels is still transient.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

In addition to the harassment of prairie chickens on booming grounds by cock pheasants (MWRL 19(2):2-3), interference with nesting activities of prairie chicken hens by hen pheasants also occurs. Some observations of this interspecies conflict were noted in MWRL 18(6):3. We have compiled additional observations on nest parasitism of prairie chickens by pheasants on the sanctuaries at Bogota.

Since 1969, 13 (3 percent) of a total of 446 prairie chicken nests have been parasitized by pheasants. Three (23 percent) of these 13 nests were successful. Eight of the nests were destroyed and two were abandoned (77 percent unsuccessful).

In contrast, of the 433 nonparasitized prairie chicken nests, 216 (50 percent) were successful.

No parasitized nests were found prior to 1970. In the years 1970-72, one parasitized nest was found each year. Ten parasitized nests have been found in the past 3 years (four in 1973, two in 1974, and four in 1975). As the number of parasitized nests increases, they constitute a growing proportion (7 percent in 1975) of the declining number of prairie chicken nests.

We believe that this parasitism is cause for concern. The incidence of parasitism is apparently increasing, as is the pheasant population. Parasitized nests are markedly less successful than nonparasitized nests. Consequently, parasitism of prairie chicken nests by hen pheasants has limited--and will probably continue to limit to some extent--the production of young prairie chickens.

MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

April, 1976

Vol. 19, No. 4

Manipulation of Pheasant Habitat

R. E. Warner

Last month's research letter (MWRL 19(3):1) reported that a survey of farmer attitudes concerning the seeded roadside program was conducted for farmers in the Ford County Management Unit (FCMU) during January 1976. The following facts were elicited from the survey:

1. Forty-seven of the 61 cooperators in the FCMU in 1968 were still farming as of January 1976, and 46 were interviewed. Of these 46, 40 (87 percent) recalled being contacted by a representative from the Illinois Department of Conservation (IDC) prior to roadside seeding in 1968.
2. Of the 46, 38 (83 percent) remembered entering into a delayed mowing agreement. Twenty-seven of the 38 (59 percent) recalled a date of 1 August or later.
3. Fifty-three cooperators were farming the FCMU as of January 1976, 52 of whom were interviewed. The following question was asked: "As a direct result of seeding roadsides to brome and vernal alfalfa in 1968, have the following items been of concern to you?" Farmers responded in the following manner:

	Increased Concern No. (percent)	Decreased Concern No. (percent)	Little or No Concern No. (percent)
a. Weeds	20 (38.5)	6 (11.5)	26 (50.0)
b. Drainage	10 (19.2)	0	42 (80.8)
c. Traffic visibility	10 (19.2)	0	42 (80.8)
d. Wildlife roadkills	5 (9.6)	8 (15.4)	39 (75.0)
e. Appearance	17 (32.7)	8 (15.4)	27 (51.9)

Total = 52 farmers

4a. Of the 52 farmers, 50 (96 percent) were aware that signs were posted to explain the seeded roadside program.

4b. Thirty-five (70 percent) know that signs were posted only around the perimeter of the FCMU.

4c. Twenty-eight (56 percent) felt that the signs were necessary.

5. Twenty-five (48 percent) of the farmers have hunted on their farms in the past 5 years.

6. Forty-three (83 percent) of the farmers would recommend the seeded roadside program to other farmers.

7. When asked for suggestions to improve the seeded roadside program, the most frequently mentioned suggestion (by 21 farmers, 40 percent) was that a weed control project should be instituted by the IDC. Spraying was mentioned by nearly all of the farmers.

Conclusions and recommendations in view of the results of the survey of FCMU farmer attitudes will be reported in next month's research letter.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Twenty years after clear-cutting, stands on the better sites contain trees 6 inches in diameter and 40 feet tall. Little understory remains, many suppressed trees are dead or dying, and the dominant trees are beginning to produce seed.

On our study area of 9.3 acres we captured nine individual gray squirrels, four taken in October, eight (four recaptures plus four new squirrels) in May, and four (three recaptures plus one new squirrel) in July. Of these nine squirrels, four were adult females, three were adult males, one was a subadult female, and one a subadult male.

Even with live traps open around the perimeter of the cut, we captured squirrels as deep as 72 meters into the clear-cut (center = 83 meters from the edge); with the outer traps closed, squirrels were captured at the center of the clear-cut. Squirrels were clearly foraging more often and at all seasons throughout the 20-year clear-cut; however, food production was not significantly higher ($P > 0.05$) in the 20-year cut compared with the 15-year cuts. For the first time since the stand was clear-cut, acorns were the most important food produced (by weight), followed by gill fungi, flowering dogwood, and grape. Thus, squirrels now had access to a storable food for the first time since the stand was clear-cut 20 years ago.

There were three leaf nests present in the 9.3-acre cut, none in use during the winter months. There were no natural dens present in the stand.

In a companion study, nest boxes were placed at a density of two per acre in another clear-cut 20 years old. For 2 years boxes were checked at intervals for squirrel use. Gray squirrels did not use the boxes during the 2-year period, but flying squirrels made extensive use of them, including raising young in several boxes.

Thus, although squirrels will forage widely in a clear-cut 20 years old, they are not permanent residents and are dependent on the uncut forest for

survival. Even when nest boxes were placed in the 20-year stand, squirrels did not take up residence, probably because the food base present in such stands was still low. Less than 200 g of storable food was produced per 0.01-ha plot on the best sites for seed production in the 20-year-old stand. In contrast, more than 2,500 g of storable seed was produced per 0.01-ha plot in the adjacent uncut forest.

In summary, wildlife managers cannot expect anything but sporadic gray squirrel utilization of clear-cut stands for up to 30 years after cutting. The food base is too small and consists mostly of perishable, not storable foods. Wildlife managers can do little for squirrels during the first 30 years after a stand is clear-cut, but there is a great deal they can do to minimize the effects of clear-cutting, before clear-cutting is done, through control of timing, size, and placement of each cut. We will consider some of these management options in the next newsletter.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

The prairie chicken population on the Bogota Study Area was censused in the spring of 1976 for the 14th consecutive year. As in past springs, booming ground surveys were conducted along with supplementary observations made by visitors in blinds almost daily from 27 March through 18 April.

Counts made this spring (1976) revealed a total of 81 cocks, a decline of 20.6 percent from the 102 cocks counted at Bogota in the spring of 1975. This count represented a third consecutive spring decline after the population's steady increase from the low point of 37 cocks in the spring of 1968. The high point was 203 cocks in the spring of 1973. As in the two preceding springs, the decline this spring can be directly attributed to a poor nesting season the previous year. Intensive nest studies at Bogota in 1973, 1974, and 1975 documented the lowest levels of nest success (31 percent, 41 percent, and 41 percent, respectively) recorded in the past 13 years. A high rate of predation on nests, a reduced food base for predators, and abnormally wet weather in 1973 and 1974 were the factors to which the poor hatches were attributed. Harassment, competition, and nest parasitism from an increasing local pheasant population has also become an apparently serious problem at Bogota.

Except for two male prairie chickens that boomed on private farmland within 1 mile of the Newton city limits, all booming grounds were again located on or adjacent to the sanctuaries at Bogota. Also, each of the seven sanctuary complexes supported at least one booming ground except the 110-acre Galbreath Sanctuary.

JUN 14 1976

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

May, 1976

Vol. 19, No. 5

Manipulation of Pheasant Habitat

R. E. Warner

The January 1976 survey of farmer cooperators in the Ford County Management Unit (FCMU) regarding their attitudes toward the seeded roadside program showed that their initial indoctrination (by way of personal contact and four subsequent letters) had oriented these cooperators to the purpose of the roadside seedings and to the importance of the delayed mowing date of 1 August. This conclusion is evidenced by our findings in 1976, 8 years after the establishment of the FCMU, that 83 percent of the cooperators recalled entering into a delayed mowing agreement (MWRL 19(4):1). In this survey of farmer attitudes in 1976, most cooperators (83 percent) expressed optimism about, and acceptance of, the program (MWRL 19(4):2). The apparent optimism is not readily explicable in view of the fact that in the previous summer, 1975, only 63 percent of the cooperators delayed the mowing of roadsides until 1 August or later (MWRL 19(3):1). We conclude that the expressed optimism about the roadside program is not in itself a sufficient impetus to cause the farmers to refrain from early mowing over consecutive summers. The following factors, listed in apparent order of importance, have substantially influenced the extent of cooperation in delayed mowing in the FCMU over the past 6 years:

1) Time available to farmer for roadside mowing

Statistical analysis reveals that phenology of crop planting is significantly related ($P < 0.05$) to the extent of early mowing on the FCMU, which presumably is indicative of the amount of time farmers have to perform secondary operations such as roadside mowing. Early crop planting results in early mowing.

2) Lack of commitment to, and enthusiasm for, the seeded roadside program

Many of the cooperators who have failed to adhere to the delayed mowing agreement did not reveal negative attitudes regarding the program when interviewed last January. In fact, several farmers who, without explanation, have abandoned the delayed mowing schedule expressed enthusiasm for the program. In addition, less than half of the cooperators in the FCMU have hunted on their farms in the past 5 years (MWRL 19(4):2); presumably far less than half have hunted in the past 2 years. Thus, only a minority of farmers are potentially enthusiastic over the roadside program because of an interest in hunting.

3) Infiltration of weeds and appearance of roadsides

Nearly the same number of cooperators expressing concern over weeds (38.5 percent) expressed concern for the appearance of the roadsides (32.7 percent, MWRL 19(4):1). When interviewed last January, farmers expressing concern for weeds typically expressed concern for appearance also. Farmers appear to be more worried about the appearance of the roadside cover than the possible effects weeds may have on crop success and harvest.

Monitoring of mowing in the FCMU in future years will determine whether occasional personal contact with farmers, as transpired last January, strengthens commitments by cooperators to delay mowing.

Farmers in the FCMU have participated in demonstrating an unorthodox practice to other farmers in the area. In central Illinois, vigorous roadside mowing connotes clean and efficient farm practices. As a pilot project, the extent to which farmers in the FCMU have cut across the traditional pattern for roadside mowing is encouraging. It is now timely for the Illinois Department of Conservation to carefully plan and execute an approach to informing a broad spectrum of people of the multiple benefits of developed roadside cover and delayed mowing. This program of education will enhance the social acceptability of the roadside program. As developed roadside cover and delayed mowing become more conventional to farmers and the general public, cooperators in the program will be more consistent in delaying the mowing of roadsides.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Clear-cutting is clearly a disaster for gray and fox squirrels, with a near total loss of storable food supplies and possible den sites. Wildlife managers must seek ways to minimize the effects of this silvicultural practice on squirrels and other species of wildlife that prefer old-growth hardwood forests.

Forest stands under management for forest products are usually inventoried at intervals to determine their condition--specifically, the feasibility of a harvest of some type. It is during this stand inventory that wildlife managers can best have an input into the silvicultural system. In turn, wildlife managers must provide foresters with methods for including in the stand inventory those parameters of the forest that are important to wildlife. Such characteristics as amount of browse available, number and species of trees with cavities, and the potential for tree seed production are necessary before wildlife managers can expect to estimate the probable effects on wildlife of any proposed treatments applied to forest stands.

For gray and fox squirrels, a storable tree seed crop (at least 130 pounds per acre of sound seed) and suitable tree cavities for nesting (a minimum of four cavities per acre observable from the ground--about half those located from

[illegible]

the ground are not good nest cavities for one reason or another) are needed to sustain reasonable densities (fall densities of 1.5-2.0 per acre).

As we have shown, both storable food and shelter are eliminated for squirrels by clear-cutting for at least 22 years postcutting (see MWRL 19(4):3).

On the basis of our 8-year study of both the immediate and long-term effects of clear-cutting on squirrels, we offer the following recommendations as guidelines for using clear-cutting where squirrels are considered important.

1. If the stand to be clear-cut is mature and contains a significant proportion of the food or shelter, or both, of the compartment as a whole, then the stand should be cut using only single tree selection until surrounding stands mature. At Truetown, survival of young gray squirrels was much reduced after clear-cutting 35 acres of the best cavity-producing stand on the entire 206-acre study area (see MWRL 18(12):1).
2. Clear-cuts should be less than 150 meters wide. At Doanville, survival of adult squirrels was not reduced by clear-cuts up to 180 meters wide, but three of seven surviving adult female gray squirrels shifted their home ranges away from the clear-cut. A clear-cut narrower than 180 meters should lessen the disruption of home ranges for resident squirrels. The average home range for a total of 34 adult female gray squirrels captured at Truetown and Doanville was 5.16 acres. We are specifying the home range of the adult female because we believe the well-being of any squirrel population depends on the number of adult females maintained in good condition during the winter months. A circle of 5.16 acres has a diameter of about 160 meters; a clear-cut with a lesser diameter should help reduce the effects of the cut on the resident adult females.
3. If the clear-cut is kept narrow and the surrounding timber is suitable to support huntable squirrel densities, then the length of the clear-cut should be dictated by site, topography, and logging constraints.
4. The retention of 0.5- to 1.0-acre islands of uncut trees in a clear-cut does not appear to be justified for squirrels alone. At Truetown there were two uncut islands left in the 35-acre clear-cut, one 0.5 acre and one 1.0 acre in size. Before cutting, nine squirrels were taken in live traps within these two islands. After cutting, only an adult male gray squirrel was captured in the 0.5-acre island located 20 m from the uncut forest. There were no squirrels captured in the 1.0-acre island located 40 m from the uncut forest. In winter, on snow, only one or two squirrels were found to be using the 0.5-acre island, and no squirrels were located in the 1.0-acre island.
5. For long, narrow clear-cuts, a strip of uncut forest up to 100 m wide should be left intact to provide wildlife with a connecting travel lane through the clear-cut. Travel lanes should be placed so as to divide a large clear-cut into areas of about 20 acres. Travel lanes should contain numerous tree cavities for protection from predators and should be well stocked with food species (oaks and hickories >14.0 inches dbh).

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6. Cleanup crews that often follow the logging operations should be instructed to leave as much soft mast (such as flowering dogwood and grape) as possible. These T.S.I. crews usually cut all dogwood trees >2.0 inches dbh, which are the best seed producers. In clear-cuts up to 20 years old, flowering dogwood is often the only consistent seed producer. We recognize that grapevines can damage young tree reproduction, particularly on good sites, but we also believe that at least some grapevines should be allowed to grow with the developing stand. Virtually all squirrel leaf nests are anchored to some kind of vine, usually a grapevine. In young clear-cuts (<40 years), leaf nests offer squirrels the only available shelter and help speed occupancy of these stands having few available cavities.

7. At least 50 percent of the forest stands surrounding a clear-cut should be retained in a seed-producing stage (>40 years) for 30 years after clear-cutting. Tree harvesting should feature only single tree selection.

8. Artificial den boxes should not be used in clear-cuts less than 30 years old, at least for gray squirrels. Gray squirrels did not use nest boxes placed in a 22-year-old stand, probably because the storable food supply was insufficient to support them. However, we believe that nest boxes can be of real benefit in clear-cuts between 30 and 60 years old. Both gray and fox squirrels used boxes placed in a 34-year-old even-aged oak stand where shelter was scarce and food was plentiful. A density of two boxes per acre is adequate for these stands.

9. Certain tree species important to squirrels do not grow fast enough after clear-cutting to compete successfully with the developing stand. The hickories and the American beech are both tolerant of shade and are usually overtopped by the more rapid-growing intolerants, such as tulip tree, ash, and many of the oaks. We fear that clear-cutting will drastically reduce the amount of hickory available for seed production during the next timber rotation. Therefore, we recommend that 10-12 hickory poles per acre (2-6 inches dbh) be left standing in any new clear-cut. Some of these stems will die after complete release, but the remainder will have a good chance of reaching seed-bearing size. There will be some loss of timber production involved in leaving these poles standing in the clear-cut, but improved habitat for squirrels should result during the last half or more of the stand rotation.

10. Finally, it should be recognized that clear-cutting can provide wildlife managers with an opportunity to change forest composition during the next rotation. A continuance of unregulated selective cutting of single trees has often increased such species as sugar maple to the detriment of oak and hickory. If enough stems of oak and hickory are available in the understory to form a new stand (new seedlings of oak and hickory produced after clear-cutting do not contribute to the new stand), then removal of the overstory by clear-cutting can increase the amount of oak and hickory in the next rotation. We also recognize that clear-cutting offers wildlife managers an opportunity to provide a diversity of habitats for an array of wildlife species, many of which are not present in old-growth closed canopy forests. If clear-cuts are carefully sited and are kept small and scattered, then populations of gray and fox squirrels will not be materially damaged by the practice.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

There were 155 prairie chicken cocks counted on seven census areas in five counties of south-central Illinois in the spring of 1976. This total was 11 percent lower than counts made on the same census areas in 1975.

In contrast to the managed flock near Bogota, which declined 21 percent since the spring of 1975 (MWRL 19(4):3), the managed flock near Farina increased from 35 cocks to 41 cocks (+17 percent), and the managed flock between Kinmundy and Forbes Park increased from 12 cocks to 16 cocks (+33 percent). A third area showing an increase was the unmanaged flock near Hoyleton in Washington County--9 cocks in 1975 to 11 cocks in 1976.

Three unmanaged census areas are on the verge of extinction with only two cocks each spring. Declines of 75 percent, 50 percent, and 60 percent were noted on the Mt. Erie, Bible Grove, and New Minden census areas, respectively, since the spring of 1975.

The flocks associated with sanctuaries in Jasper and Marion counties constitute 89 percent of the known statewide population of prairie chickens. As in the spring of 1975, the Bogota flock did not fare as well this spring as the smaller flocks on managed areas in Marion County. Even the small flock at Hoyleton, which lacks a sanctuary system, has held a stable population level over the past 3 years. However, the densities of prairie chickens on Illinois' managed areas, expressed as cocks per section of managed habitat, were 51.9, 186.4, and 32.0 on the Bogota, Farina, and Kinmundy areas, respectively. These densities are high compared with population levels of prairie chickens in other states, including four states where prairie chickens are sufficiently abundant to justify hunting seasons.

1. 10. 1963

2. 11. 1963

3. 12. 1963

4. 1. 1964

5. 2. 1964

6. 3. 1964

MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

June, 1976

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Manipulation of Pheasant Habitat

R. E. Warner

Roadside counts of pheasants in spring are included in the annual censusing activities for the Sibley Study Area (SSA) and Ford County Management Unit (FCMU). For 1976, roadside counts were conducted during the last week of April for the SSA and during early May for the FCMU. Results of the roadside counts were converted to a density (pheasants per section) estimate (Table 1). Inherent in these density figures is an assumed mortality of 15 percent for both sexes, December through April. Calculations of density estimates utilize information on winter sex ratios (3.6 hens per cock, January 1976 on the SSA and FCMU) and a conversion factor derived from years when aerial census work has documented actual bird densities for the SSA and FCMU in December.

From the spring roadside counts in 1976, density estimates indicate an 86 percent increase in pheasant numbers over 1975 for the SSA and 27 percent increase in pheasant numbers for the FCMU (derived from Table 1). These density figures are evidence that a greater surviving population of pheasants exists on the SSA and FCMU in May 1976 than a year ago.

Density figures from Table 1 indicate that this spring there are more pheasants per section in the SSA than in the FCMU. However, cock call counts currently being conducted in both study areas do not, at the present point of completion, substantiate this finding; conversely, they indicate that the FCMU has greater pheasant densities than the SSA.

Next month, after completion of audio censusing, the results of the call counts will be compared for the SSA, FCMU, and the three townships proposed for future roadside seeding.

Table 1. Estimated numbers of pheasants per section, 1 May 1967-76, derived from visual roadside counts on the SSA and FCMU.

Year	SSA	FCMU
1967	28	19
1968	33	27
1969	36	26
1970	33	14
1971	51	51
1972	42	77
1973	47	88
1974	56	85
1975	28	37
1976	52	47

NATURAL HISTORY SURVEY

JUL 9 1976

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Ecology and Management of Squirrels

C.M. Nixon,
S. P. Havera

Monitoring the reproductive status of squirrel populations in late winter and early spring often indicates the successfulness of the approaching squirrel season. Squirrels born in February and March, from the first or winter breeding season, are available to hunters at the beginning of the season in August and September. However, squirrels born in July and August, from the second or summer breeding season, do not become self-dependent and available to hunters until October, when interest in squirrel hunting is waning.

The reproductive condition of squirrels in east-central Illinois has been monitored for six consecutive springs. Two study areas in Vermilion County have been livetrapped for 10 days in May since 1971. The numbers of adult female squirrels in breeding condition were noted. Based on sample sizes of between 20 to 40 adult female fox and gray squirrels, the proportions that had spring litters were 75 percent, 84 percent, 69 percent, 33 percent, 96 percent, and 79 percent in 1971, 1972, 1973, 1974, 1975, and 1976.

One key to spring squirrel reproduction is the abundance of nuts in the fall. If mast crops are normal or abundant, squirrels feed well in the fall, enter the winter months in good condition, and have an ample supply of nuts stored for consumption during the winter months. When the breeding season arrives in late December, January, and February, the adult female squirrels that have had an adequate fall and winter diet are in sufficiently good physical condition to enter estrus. Then, depending on the size of the population, reproduction is average or above. If, however, the nut crop is low, then reproduction may be below average. A poor mast crop coupled with a severe winter can drastically reduce spring reproduction as well as squirrel populations.

Information collected over a period of years at the same locality provides valuable clues to the interpretation of population changes of animals. For instance, the squirrel breeding data previously presented document the response of spring squirrel reproduction, and therefore squirrel population size, to the size of the fall nut crop.

Four of the six values for the spring breeding rate from 1971 to 1976 range from 69 to 84 percent. The two other values, 33 percent in 1974 and 96 percent in 1975, are unusual. However, the nut crops preceding both these breeding seasons were abnormal. Mast was extremely scarce in the fall of 1973 and the winter of 1973-74 brought heavy snowfall and below average temperatures. The result was low squirrel reproduction (33 percent) in the spring of 1974. The next year was just the opposite. In the fall of 1974, mast--particularly the white oak crop--abounded. The winter of 1974-75 was mild. Hence, the spring reproduction rate in 1975 was remarkably high (96 percent). Population densities during both of these breeding seasons were similar; 24 adult females were examined in 1974 and 26 were examined in 1975.

Squirrel hunters should have an average or better season this coming fall. Examination of 78 adult fox and gray female squirrels throughout central Illinois provided a spring breeding rate of approximately 78 percent, thus reflecting an average or better mast crop throughout central Illinois last fall. The value for 1976 falls between the values of 51 percent and 89 percent in southern and central Illinois, 1974 and 1975.

This spring, freezing temperatures in late April and early May throughout Illinois may have occurred when many of the nut trees were flowering. Although it is too early to assess the damage, the mast crop may be reduced this fall in some areas.

Responses of Prairie Chickens to Habitat ManipulationR. L. Westemeier,
D. R. Vance

During the spring of 1976, 50 groups totaling 374 people made reservations and visited the prairie chicken booming grounds in Jasper County. We started the season for visitation by the public on 27 March and terminated the season on 23 April; a total of 24 mornings were involved. Students and staff from 14 different universities and colleges represented 55 percent of the total number of individuals, and 13 Audubon or ornithological societies supplied 24 percent. Other groups including newswriters, scout troops, and personnel of state agencies, museums, and private environmental agencies made up 12 percent of the total; various other individuals represented 9 percent.

Illinois supplied 44 percent of the visitors in 1976, Ohio 24 percent, Indiana 21 percent, and lesser numbers came from Tennessee, Missouri, Pennsylvania, Kentucky, Iowa, New Jersey, Michigan, and Rhode Island.

As in previous springs, visitors aided the research project by recording their observations during 46 blind mornings (one booming ground under observation for at least 2 hours by one or more observers in one or more blinds per morning). Hens began visiting the booming grounds on 18 March, with peak numbers noted from 28 March through 7 April. The first of 40 copulations recorded this spring was seen on 29 March; a peak in breeding was evident about 2 April; and a sharp decline in breeding activity occurred after 9 April. Preliminary analyses of these data indicate one of the earliest breeding seasons on record, although not so early as one would expect in view of the early spring. The usual peak in breeding occurs about 6 April, thus the spring of 1976 was only about 4 days early insofar as the phenology of prairie chicken breeding activity was concerned.

Observer records also indicated that the spring of 1976 was characterized by little disturbance or harassment by natural factors on the booming grounds. Harriers were the most common source of disruption, but these raptors caused flushing of prairie chickens on only 17 percent of the blind mornings in 1976 in contrast to 78 percent of the blind mornings in 1975. Mild reactions were noted to the presence of a short-eared owl, red-tailed hawk, blue jay, and coyote on one blind morning each. No interaction was noted between pheasants and prairie chickens on six blind mornings (when both species were present), but on one occasion two prairie chicken cocks drove a cock pheasant off the booming ground. The most violent reaction (most prairie chickens flushing) noted during the spring of 1976 resulted from two white-tailed deer bounding across a booming ground.

1. The first part of the document is a letter from the President of the United States to the Congress, dated January 1, 1861. It is a very important document, as it contains the President's message to the Congress at the beginning of his first term.

2. The second part of the document is a report from the Secretary of the Treasury, dated January 1, 1861. It contains information about the state of the Treasury and the country's financial situation at the time.

3. The third part of the document is a report from the Secretary of the Interior, dated January 1, 1861. It contains information about the state of the Interior and the country's natural resources at the time.

4. The fourth part of the document is a report from the Secretary of the Navy, dated January 1, 1861. It contains information about the state of the Navy and the country's naval forces at the time.

5. The fifth part of the document is a report from the Secretary of the War, dated January 1, 1861. It contains information about the state of the War and the country's military forces at the time.

MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

July, 1976

Vol. 19, No. 7

Manipulation of Pheasant Habitat

R. E. Warner

Last month's research letter (MWRL 19(6):1) reported estimated densities of pheasants on the Sibley Study Area (SSA) and Ford County Management Unit (FCMU). The number of pheasants per section was determined from roadside counts conducted during late April and early May. Cock call counts were also included in this spring's census activities. Biologists from the Illinois Department of Conservation recorded cock calls along routes in the SSA, the FCMU, and the three townships that are proposed for future roadside seeding.

Cock calls were recorded during nine mornings per area (the SSA excepted) during the first 3 weeks of May. Of the nine counts conducted per area, total counts for the five mornings in which numbers of calls were highest were averaged to derive the figures listed in Table 1. On the SSA, however, counts were conducted on only two mornings and therefore may not accurately reflect the numbers of pheasants in this area.

Table 1. Pheasant cock calls recorded during May 1976 on the SSA, the FCMU, and the three townships proposed for future roadside seeding.

Area	County	Average Number of Calls per 2-minute Stop
SSA	Ford ^a	13.7 ^a
FCMU	Ford	21.0
Anchor Township	McLean	19.9
Harwood Township	Champaign	11.5
Prairie Green Township	Iroquois	28.4

^a Call counts conducted on only two mornings.

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Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Fox squirrels comprise about 75 percent of the Illinois squirrel population. Fox squirrels are adaptable animals that capitalize on man's manipulation of habitat. Unlike gray squirrels, which are creatures of extensive forests, fox squirrels frequent small woodlots, sparse open woods, and even hedgerows. One reason fox squirrels can exist in such sparsely wooded areas is their ready acceptance of cash-grain crops. A wide variety of food may not be as abundant in small areas of timber as in large tracts of woodland. However, corn and even soybeans can provide a source of nourishment for fox squirrels from late summer to early spring, particularly when there is no fall plowing.

Little is known about the use of soybeans by squirrels. Nutritionally, soybeans are high in protein (57 percent), moderate in carbohydrates (33 percent), low in fat (1 percent), and fairly high in energy (5,454 cal/g). For comparison, the germ of corn kernels that squirrels eat is higher than soybeans in carbohydrates (53 percent) and fat (8 percent) but lower in protein (20 percent) and energy (4,443 cal/g). Thus, soybeans are a high-protein food source and a fair energy source.

To obtain data on the use of soybeans by--and their availability to--squirrels and other wildlife during the fall and winter, a study area adjacent to a stand of mature timber was selected at a Lake Shelbyville Wildlife Management Area. Four rows of soybeans next to the timber were left unharvested. In October, five plots were established along these four rows. Every 10th soybean plant was marked. The numbers of unopened pods on these plants were counted and the numbers of pods above the ground and on the ground were noted. The soybean plants and pods were counted four times from October 15 to March 30. The plots were also checked after each snowfall to see what animals were using the unharvested soybeans.

The tracks found in plots showed that deer, quail, and mice made heavy use of the soybeans as food. Rabbits and an occasional pheasant were also present; they may have been using the soybeans as food or cover, or both. No squirrel tracks were seen in the plots. About 80 percent of the soybean pods were utilized as food or disappeared during the fall and winter. Of the pods remaining in late March, 63 percent were aboveground, and most of them would probably have stood above an average snowfall.

Although no squirrels were observed to use these soybean plots, two different instances of squirrel usage of soybeans were noted in early February after a brutal January. In Vermilion County, tracks of at least 15 different squirrels were seen in a harvested soybean field adjacent to a large tract of timber. The squirrels were foraging down each row of soybeans and opening pods and eating all but the skins of the soybeans. The ground was covered with tracks as far as 40 yards into the field. A few days later in Champaign County, in a snow-covered soybean field adjacent to a woods, two fox squirrels were seen opening pods that were on stalks protruding above the snow.

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To determine whether squirrels liked soybeans and how much of a soybean diet they would eat in a day, four captive adult female fox squirrels were fed soybeans for 3 days in late January. All but one of the squirrels were somewhat reluctant to eat the soybeans, but by the end of the third day all four squirrels were eating them. However, the average daily energy intake of the four squirrels on the soybean diet was, respectively, only 4.6 percent, 9.1 percent, 27.5 percent, and 61.0 percent of their January average intake on a balanced diet.

Fox squirrels do eat soybeans and some may eat them more than others. Once squirrels learn to eat soybeans, waste or unharvested soybeans may be an important food source for squirrels and other wildlife during the late winter and early spring months of a year with low food production and severe winter weather.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Hatch success for prairie chicken nests on sanctuary grasslands averaged 67 percent--and was not less than 50 percent for any year--for the 10-year period of 1963-72 on the Bogota Study Area. By contrast, mammalian predation (primarily) reduced nest success to 31 percent in 1973 and to 41 percent in both 1974 and 1975. Sharp decreases in the prairie chicken population were correlated with the low levels of nest success. Preliminary data indicate a level of hatch success of approximately 30 percent again in 1976--again largely due to predation.

In an effort to learn (1) the species of mammalian predators making frequent use of the sanctuaries and (2) whether control measures can demonstrate an improvement in sanctuary utilization, hatch success, or chick survival, limited trapping efforts were conducted in selected portions of the sanctuaries during the past 4 years. Most trapping was done with live traps; however, Conibear-type traps were tried 1 year (1975). Trapping was primarily limited to April and May, the most important months of the nesting season for prairie chickens. Various baits were used including domestic chicken eggs, fish, road-killed rabbits, peanut butter, and dog food.

In Jasper County, during the 4 years 1973-76, a total of 2,455 trap-nights resulted in 46 captures of at least potential "egg eaters." Fifty-three percent of the captures were opossums, 11 percent dogs, 10 percent raccoons, 9 percent cats, and 4 percent skunks. Similarly, in Marion County, during the 3 years 1974-76, 762 trap-nights resulted in 19 captures; 58 percent were opossums, 16 percent raccoons, 16 percent cats, and 11 percent dogs. Trap-nights per capture have decreased steadily from 175.0 to 35.7 in Jasper County and from 200.0 to 34.3 in Marion County. These data suggest either an increased proficiency in trapping or an increasing mammal population, or both, in both counties.

The first part of the document is a letter from the President of the United States to the Congress, dated January 3, 1862. It is a very important document, as it contains the President's annual message to Congress. The letter is written in a formal, dignified style, and it is one of the most important documents in the history of the United States. It is a document that has been read and studied by many generations of Americans, and it is a document that has shaped the course of the nation's history.

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THE PRESIDENT'S MESSAGE TO CONGRESS, JANUARY 3, 1862.

My friends, I have the honor to acknowledge the receipt of your letter of the 29th inst., and in reply to inform you that the same has been forwarded to the proper authorities for their consideration. I am, Sir, very respectfully, Sir, your obedient servant.

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The trapping efforts and the disposal of captured mammals present some problems, primarily because of local public relations. For this reason most trapping in the past and probably all future trapping on sanctuaries will be restricted to box-type live traps. Opossums (and their litters) and skunks are destroyed. Raccoons are transplanted out of the sanctuary area. Dogs and cats are returned to their owners, if known, set free if they are of obvious value and their owners are not known, or destroyed if they are judged to be free-ranging or feral mongrels.

The effectiveness of our trapping efforts is difficult to assess. To date, there appears to be little evidence that utilization of the sanctuaries by prairie chickens, hatch success, or brood survival can be increased by trapping predators. Similarly, there is little or no indication that the removal of approximately 150 coyotes last winter by local hunters--plus sizable numbers in previous winters--from southwestern Jasper County and portions of nearby Richland and Clay counties has had any noticeable effect in promoting the welfare of prairie chickens or other wildlife on the sanctuaries.

MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

NATURAL HISTORY SURVEY

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August, 1976

Vol. 19, No. 8

Manipulation of Pheasant Habitat

R. E. Warner

Roadsides in the Ford County Management Unit (FCMU) seeded in 1968 were considered to be mature as of the summer of 1970. Each farmer cooperator agreed to refrain from mowing these roadsides prior to 1 August in subsequent years. Since 1970, the phenology of roadside mowing has been monitored in the FCMU to determine the extent to which cooperators adhere to the delayed mowing agreement. The percentages of the 73 cooperator-miles of roadsides in the FCMU unmowed as of 1 August have been determined as follows: 63 percent in 1970, 68 percent in 1971, 78 percent in 1972, 80 percent in 1973, 87 percent in 1974, and 63 percent in 1975.

The increase in early roadside mowing in 1975 was related to the unusually early planting season, which resulted in a greater-than-average amount of time available to farmers during June and July for mowing activities. Another factor that may have influenced the problem of early roadside mowing was that cooperators in the FCMU had not been systematically contacted and personally encouraged to refrain from early mowing since 1970. Thus, during January 1976, each cooperator was contacted and encouraged to continue to delay mowing activities until 1 August in future years.

This subsequent mowing season of 1976 has been ideal for observing any changes in roadside mowing patterns that may have resulted from the recent personal contact of FCMU cooperators. The planting season for 1976 was again untypically early, and the subsequent time available to farmers for mowing activities appeared nearly identical to that of 1975. As of 1 August 1976, 64 percent of the FCMU roadsides were unmowed, similar to the 63 percent unmowed in 1975. Thus, there is no evidence that the recent contacts with farmer cooperators had a positive effect in delaying roadside mowing.

With the assistance of biologists from the Illinois Department of Conservation, mature seedings on previously graded roadsides scattered throughout Ford County were monitored for mowing phenology, as well as the three townships that are scheduled for roadside seeding activity this fall (Table 1). As indicated in Table 1, the graded roadsides in Ford County that have been seeded experienced over twice the extent of early mowing (79 percent mowed) as did the FCMU roadsides (36 percent mowed). The near-total extent of roadside mowing prior to 1 August as determined for the three areas of future seeding is considered to be representative of present mowing trends in east-central Illinois.

Table 1. Phenology of roadside mowing, 1976.

Location	Total Miles	Percent of Total Miles Unmowed
		Prior to 1 August
FCMU	73	64
Ford County graded	82	21
Anchor (McLean Co.) ^a	73	3
Harwood (Champaign Co.) ^a	166	7
Prairie Green (Iroquois Co.) ^a	165	13

^a Future seedings are planned in these townships; farmers have not yet been asked to participate in the roadside program.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Wildlife biologists have often stated that winter is the bottleneck for wildlife populations. Severe winter weather combined with low food supplies can drastically reduce animal populations. Providing supplemental feed during the winter months is often mentioned as a possible means to counteract a low supply of wildlife food. One method of providing winter food is to leave unharvested grain in fields adjacent to good wildlife cover.

Six rows of standing corn were left unharvested in two fields on the McLean County Conservation Area last winter. In one field, the rows of unharvested corn were adjacent to a mature oak-hickory forest; in the other field, the unharvested corn was next to a young oak-hickory forest. Four study plots were established in the standing corn rows in early September. The total number of ears, the number of ears above the ground, the number of ears on the ground, the number of ears eaten by wildlife, and the number of ears eaten by squirrels were monitored in these plots from September to early April. In addition to counting the ears, the outer 30 meters of the woods adjacent to the plots were searched for fresh corncobs that squirrels carried into woods. The study plots were visited after each snowfall to note which species of wildlife were utilizing the standing corn for food, cover, or both.

Several trends were evident in the data collected. The number of ears of corn available to wildlife in all four plots gradually decreased from September to April. The total number of ears counted in September was 1,319; in November there were 1,111 ears counted; and in February and April the total counts were 1,028 and 891, respectively. A total of 428 or 32.5 percent of the ears present in September disappeared and were probably used by wildlife during the winter. The biggest decrease in the number of ears occurred

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between September and November. It is important to note that in April, almost 68 percent of the ears were still available as wildlife food although some of the ears were beginning to deteriorate.

The number of ears aboveground decreased through the winter as the stalks decayed. In September, 89.5 percent of the ears were aboveground; in April, only 44.9 percent would have stood above a normal snowfall.

The number of incidents of animal usage within the plots was highest in late winter. In February, 57 ears had recently been eaten by wildlife and 109 ears had recently been consumed in April; of these, squirrels ate 1 ear in February and 4 in April.

Based on the number of fresh cobs found, squirrels relied more on the unharvested corn in March and April than in the previous months. A total of 58 fresh cobs were found in April whereas none, 15, and 19 were found in September, November, and February, respectively.

The tracks found after snowfalls through January indicated that squirrels often fed on osage orange, hickory nuts, and acorns at the edge of the woods and did not enter the cornfield. Some squirrel use of the standing corn was noted, but on one occasion a squirrel passed through the standing corn to feed on waste combined corn. Deer and quail often passed through the standing corn to feed on waste combined corn, but raccoons and mice, and also deer, fed on the standing corn.

Track observations in late spring were prevented by the unusually mild weather, but squirrel use of unharvested corn seemed to be light through January. Squirrels apparently fed on nuts and osage orange as long as they were available. Corn may be most important in late February, March, and early April, when the supply of natural foods is low and before the spring foods appear.

Because about two-thirds of the corn in the plots was still present in April, and since many wildlife species seemed to feed on combined corn as readily--or even more readily--than on standing corn, it may be less wasteful for man and just as beneficial to wildlife to harvest the corn if (1) the fields are not fall-plowed, (2) the efficiency of combines is not greatly improved, thereby leaving less waste grain in the fields, and (3) if waste corn left on the ground does not rot by 1 April.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Abandonment of prairie chicken nests was uncommon during the period of 1963 through 1968 on the Bogota Study Area. Intact, deserted eggs were found in only 2 (1.7 percent) of 120 prairie chicken nests during this 6-year period. Flooding was the apparent cause of one desertion and a road-killed hen was found near the other nest.

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By contrast, during the last 8 years from 1969 through 1976, 33 cases (6.7 percent) of nest desertion were noted among a sample of 496 prairie chicken nests. This period coincides with the period of (1) increasing numbers of pheasants, (2) pheasants commonly nesting, (3) increasing parasitism of prairie chicken nests by pheasants, and (4) observations of interspecific harassment on the sanctuaries. In two cases where prairie chicken nests were parasitized by pheasants, the eggs of both species were intact and deserted in one nest, whereas in the other nest 12 prairie chicken eggs were intact and deserted but 5 of 7 pheasant eggs were hatched. Thus, the failure of the two prairie chicken nests was clearly related to interference by pheasants.

The causes of desertion were less certain for the remaining 31 nests. However, pheasant nests or parasitized prairie chicken nests were found within 402 meters (1/4 mile) of 19 (61 percent) of these 31 deserted nests. Also, pheasants were commonly seen or heard crowing during the breeding season in the vicinity of 26 (84 percent) of the 31 abandoned nests. Thus, although proof is lacking, there is reasonable evidence to suspect that pheasants are causing a high percentage of the abandonment of prairie chicken nests on the Bogota Study Area. Nest desertion and parasitism due to pheasants (MWRL 19 (3):3) are thus coinciding with high levels of nest predation by mammals (MWRL 19(7):3) to severely limit reproductive success and thereby depress population levels of prairie chickens at Bogota during the past 4 years.

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

September, 1976

Vol. 19, No. 9

Manipulation of Pheasant Habitat

R. E. Warner

Summer field activities on the Ford County Management Unit (FCMU) have been completed for 1976. Cover mapping shows that corn and soybean acreages have continued to expand in the FCMU. Hay acreages diminished to 108.1 acres (1.06 percent) this year, compared with 116 acres in 1975, 121 acres in 1974, and 229 acres in 1973. Similarly, pastureland was reduced from 144 acres in 1975 to 63.6 acres (0.62 percent) in 1976. Small grain acreages were reduced to 212 acres (2.07 percent) in 1976, compared with 257 acres in 1975 and 376 acres in 1974.

Densities of hatched pheasant nests on roadsides in 1976 were substantially greater than in 1975 but did not approach the high densities documented in 1973 and 1974 (Table 1). For the nest season of 1976, roadsides on the FCMU resumed the status of principal nest cover, with an estimated average of 4.7 hatched nests per section in 1976, compared with 2.7 in 1975, 12.1 in 1974, and 12.8 in 1973 (Table 2). In 1976, 52.8 percent of all successful pheasant nests in the FCMU hatched in roadside cover, compared with 26.2 percent in 1975, 58.5 percent in 1974, and 38.7 percent in 1973 (Table 2).

Nest studies on the Ford County graded roadsides were initiated in 1976. No nests were found in the 9.9 acres of seedings (1975) that were searched. The nest searches conducted on 52.4 acres of mature (seeded in 1972 and 1974) roadside cover in Ford County indicated totals of 0.44 established pheasant nest per acre and 0.17 hatched nest per acre. The density of 0.17 hatched nest per acre for the Ford County graded roadsides was greater than the density of hatched nests that was determined for all types of cover searched on the FCMU, other than roadsides.

The brood runs for 1976 have been completed for both the FCMU and the Sibley Study Area (SSA). On the SSA, 10.0 broods were observed per 100 miles of driving in 1976, compared with 30.1 in 1975, 63 in 1974, 22.7 in 1973, and 21.4 in 1972. On the FCMU, 29.4 broods were observed per 100 miles of driving in 1976, compared with 54.4 in 1975, 17.1 in 1974, 35.0 in 1973, and 47.2 in 1972. The numbers of broods observed on the two areas represent substantial declines from the numbers observed in 1975. However, any real decrease in pheasant numbers occurring from 1975 to 1976 may be overaccentuated in the brood census figures. A relative change in pheasant numbers occurring from August 1975 to August 1976 is perhaps better reflected by the estimated total numbers of hatched nests per section (10.3 per section, 1975; 8.9 per section, 1976) (Table 2). These estimates of hatched nest densities reveal a decline of 13.6 percent in the number of broods hatched on the FCMU.

UNITED STATES DEPARTMENT OF AGRICULTURE

OFFICE OF THE SECRETARY

Washington, D. C.

January 1, 1911

C. O. P.

Washington, D. C.

January 1, 1911

Dear Sir:

I have the honor to acknowledge the receipt of your letter of the 28th inst.

in relation to the matter of the proposed amendment to the Act of March 3, 1907, relating to the regulation of the commerce with foreign countries, and in reply to inform you that the same has been forwarded to the proper authorities for their consideration.

I am, Sir, very respectfully,
Very truly yours,
Secretary

Enclosed for you are two copies of the proposed amendment to the Act of March 3, 1907, relating to the regulation of the commerce with foreign countries, and one copy of the report of the Committee on Commerce and Customs, House of Representatives, on the same.

I am, Sir, very respectfully,
Very truly yours,
Secretary

With the assistance of personnel from the Illinois Department of Conservation, brood counts were transected across the three townships where block roadside seedings will be located in the future. There were 19.0 broods observed per 100 miles in Prairie Green (Iroquois County), 7.5 broods per 100 miles in Harwood (Champaign County), and 17.7 broods per 100 miles in Anchor (McLean County).

Table 1. Pheasant nest densities determined for cover types in the Ford County Management Unit, 1973-76.

Cover	1973		1974		1975		1976	
	Total Nests per Acre	Hatched Nests per Acre	Total Nests per Acre	Hatched Nests per Acre	Total Nests per Acre	Hatched Nests per Acre	Total Nests per Acre	Hatched Nests per Acre
Roadsides	4.44	1.30	2.50	1.23	1.23	0.27	1.39	0.48
Hay	2.40	0.48	0.96	0.33	0.86	0.02	0.59	0.10
Pasture	0.82	0.34	0.40	0 ⁺	0.64	0 ⁺	0.38	0 ⁺
Small grains	0.23	0.08	0.21	0.03	0.29	0.06	0.27	0.09
Strip & non-agricultural	0.79	0.24	0.56	0.14	0.59	0.17	0.45	0.06

Table 2. Estimated density of hatched nests per section in the Ford County Management Unit, 1973-76.

Cover	Hatched Nests per Section			
	1973	1974	1975	1976
Roadsides	12.8	12.1	2.7	4.7
Hay	6.9	2.5	0.1	0.7
Pasture	2.2	0 ⁺	0 ⁺	0 ⁺
Small grains	1.9	0.7	0.9	1.2
Strip & non-agricultural	9.3	5.4	6.6	2.3
Total hatched nests per section	33.1	20.7	10.3	8.9
Percent hatched nests per section from roadsides	38.7	58.5	26.2	52.8

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Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Two years of winter feeding and livetrapping have been completed in mature timber stands at Forest Glen County Preserve in Vermilion County, Illinois. During the first year on the 32-acre (13-hectare) experimental area, 807 pounds of shelled corn were provided for squirrels and other wildlife from December through March. Last winter, 1,150 pounds of shelled corn were supplied from November through March. During both winters of feeding, the weather was not severe and the mast crops were at least average.

Last winter, in a companion study of winter feeding and livetrapping, the control and experimental areas were located in young pole-sized timber stands at Wolf Creek and Eagle Creek state parks at Lake Shelbyville in Shelby County, Illinois. A total of 365 pounds of shelled corn was supplied on the 20-acre (8-hectare) experimental area from November through March.

Table 3 presents the results of livetrapping on the winter feeding areas. In the mature timber study area in Vermilion County, the squirrels livetrapped on the feed and control areas, before and after winter feeding, were almost identical in number and in changes in number for the 2 years.

Table 3. The number of squirrels livetrapped, the number caught per thousand trap-days, and the number of trap-days before and after winter feeding at the Vermilion County and Shelby County study areas for the winter seasons of 1974-75 and 1975-76.

Area	Before Feeding			After Feeding		
	Number of Squirrels Trapped	Number Trapped per Thousand Trap-days	Number of Trap-days	Number of Squirrels Trapped	Number Trapped per Thousand Trap-days	Number of Trap-days
1974-75						
Vermilion Co. feed area	23	63.9	360	34	94.4	360
Vermilion Co. control area	14	38.9	360	20	79.4	252
1975-76						
Vermilion Co. feed area	24	74.5	322	36	112.5	320
Vermilion Co. control area	15	46.7	321	20	79.7	251
Shelby Co. feed area	--	----	---	15	150.0	100
Shelby Co. control area	--	----	---	15	150.0	100

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More squirrels were livetrapped on the feed area, but this area may normally support a higher squirrel population. During the livetrapping period after winter feeding on the pole-sized timber stands in Shelby County, the numbers of squirrels caught on the experimental and control areas were the same. The higher values for the number of squirrels livetrapped per thousand trap-days on the Shelby County areas (Table 3) as compared with the Vermilion County areas is due to the shorter trapping period (5 days) in Shelby County.

There were some differences in the incidence of sarcoptic mange (Sarcoptes scabiei) on the Vermilion County areas. During the two prefeeding trapping periods, 5 of 47 squirrels examined on the feed area had mange whereas 3 of 29 squirrels examined on the control area were infested with it. However, in the two spring trapping periods after winter feeding, 13 of 70 squirrels examined on the feed area had mange whereas 12 of 35 squirrels on the control area were mange infested. The higher rate of mange on the control area in spring was evident in 1975, when 10 of the 20 squirrels examined had mange. The incidence of mange was similar on the Shelbyville areas in the spring of 1976, after winter feeding. Fifteen squirrels were examined on both the feed and control areas. Four squirrels on the feed area and three squirrels on the control area had mange or disease.

After winter feeding, spring reproduction on all of the study areas was high and was similar for the 2 years. However, there was a noticeable difference in reproduction during the fall of 1975 on the Vermilion County feed area. Eight of 11 adult females on the feed area raised young whereas only 2 of 6 adult females examined on the control area had fall litters.

One more year of winter feeding will be done on the Vermilion County and Shelby County study areas, thus providing 3 years of data for the evaluation of any merits of winter feeding for squirrels.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

For the fourth consecutive year, nest success on the sanctuaries at Bogota was below 50 percent. Of the 45 nests found this summer, 2 (4.4 percent) were abandoned, 24 (53.3 percent) were destroyed by predators, 3 (6.7 percent) were destroyed by a wildfire, and only 16 (35.6 percent) were successful. These 16 successful nests produced at least 149 chicks. In 1975, 24 successful nests produced 219 chicks.

Nest parasitism by pheasants (see MWRL 19(3):3) was evident again this year. Four nests (8.9 percent) were parasitized. One of these nests hatched, producing at least three prairie chicken chicks and probably no pheasant chicks. The remaining three parasitized nests were destroyed by predators.

Hen kills occurred at 2 of the 24 nests destroyed by predators, an increase from 3.4 percent last year to 8.3 percent in 1976. However, this kill rate was still lower than the mean of 11.4 percent over the previous 13-year period.

The first part of the report deals with the general situation of the country. It is a very interesting and informative study of the country's development. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country's development.

The second part of the report deals with the economic situation of the country. It is a very interesting and informative study of the country's economic development. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country's economic development.

The third part of the report deals with the social situation of the country. It is a very interesting and informative study of the country's social development. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country's social development.

The fourth part of the report deals with the political situation of the country. It is a very interesting and informative study of the country's political development. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country's political development.

The fifth part of the report deals with the cultural situation of the country. It is a very interesting and informative study of the country's cultural development. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country's cultural development.

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The number of fertile eggs per clutch increased from 9.7 to 10.9 and the number of hatched eggs per clutch increased for the second year from 9.6 to 10.5. However, these slight gains can not begin to offset the effects of fewer nests and a low rate of nest success. As noted in MWRL 18(9):4, it appears that success of the hatch must be about 50 percent to maintain a stable population. The continued high rate of nest predation in 1976, therefore, portends another decline in the population level of prairie chickens at Bogota for the spring of 1977.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

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Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson, Editor

Urbana, Illinois

October, 1976

Vol. 19, No. 10

Manipulation of Pheasant Habitat

R. E. Warner

The number of pheasants harvested during the 13-14 November opening weekend of the 1976 hunting season is expected to be down from the numbers killed by hunters on the Sibley Study Area (SSA) and Ford County Management Unit (FCMU) in 1975. Broods observed in August along transect routes on both areas of study and densities of hatched nests determined for the FCMU reveal a substantial decline from the level of nesting success noted in 1975 (MWRL 19(9):1).

Although the number of cock pheasants harvested during the opening weekend in 1976 is expected to be less than one year ago, the average hunter may experience greater opportunity to kill a bird in 1976 than in 1975. In comparison to this fall, corn harvest and subsequent plowing was more advanced in 1975 (approximately 25 percent of the corn was harvested on the study areas by 14 October 1976, compared with 50 percent harvested by 14 October 1975). The advanced harvest and plowing activities in 1975 concentrated birds on the few farms where permanent cover existed. Thus, a high percentage of pheasants was available to only a relatively small proportion of hunters. This fall the phenology of corn harvest and plowing is behind that of 1975, and pheasants may therefore be less concentrated in permanent cover, which will result in a greater proportion of hunters encountering pheasants on the farms they hunt during the opening weekend.

Ecology and Management of SquirrelsC. M. Nixon,
S. P. Havera

Various mammalogists believe that two subspecies of gray squirrels occur in Illinois. The southern gray squirrel (Sciurus carolinensis carolinensis) occurs throughout the southern and southeastern portion of the United States. This southern subspecies is believed to occur in central and southern Illinois. The northern gray squirrel (S. c. pennsylvanicus) occurs throughout the northern and northeastern portion of the United States. The northern subspecies supposedly occurs in the northern half of Illinois. The northern subspecies of the gray squirrel is larger than the southern subspecies, and it has a greater tendency to be partially or completely melanistic.

We wanted to determine (1) if two different subspecies of gray squirrels occur in Illinois and (2) if there are two subspecies, where does each occur within the state. We are particularly concerned with the northern third of

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Illinois because increasing crop acreages and urban expansion are rapidly removing squirrel habitat. We wanted to know which subspecies of gray squirrel was being affected by this habitat destruction.

For comparison of the gray squirrels occurring in Illinois, we divided the state into a series of river drainages. Gray squirrels from the following river systems were compared: the upper Mississippi River, the middle Mississippi River, the Rock River, the upper Illinois River, the lower Illinois River, the Vermilion River, the Wabash River, the Little Wabash River, the Embarras River, the Kaskaskia River, the Big Muddy River, and the Shawnee Hills area. Personnel at several state parks, biologists, and many squirrel hunters throughout the state provided us with gray squirrel specimens. Museums which had Illinois gray squirrel specimens were visited. We also received specimens from museums in Wisconsin and Mississippi. Wisconsin contains the northern subspecies of the gray squirrel whereas the southern subspecies occurs in Mississippi. The Wisconsin and Mississippi specimens were used as standards for comparison with our Illinois gray squirrels.

Our analyses were based on sixteen cranial measurements of the gray squirrels. Cranial measurements are an indicator of body size. Almost 400 specimens were used in the analyses. The gray squirrels were compared with statistical analyses performed on a computer.

The results show a very significant size difference between the smaller Mississippi specimens (the southern subspecies) and the larger Wisconsin specimens (the northern subspecies). The Illinois squirrels seem to follow somewhat of a clinal variation in size between Mississippi and Wisconsin squirrels. The southern Illinois squirrels are smaller and are more similar to the southern subspecies. Northern Illinois squirrels are larger and are similar to the northern subspecies. However, gray squirrels in most of the areas in the state seemed to favor the southern subspecies. The gray squirrels in the upper Mississippi River and the Rock River were very similar to the northern subspecies specimens. The upper and lower Illinois River squirrels slightly favored the northern subspecies. Gray squirrels in the remainder of the state were more similar to the southern subspecies. Visual observations seemed to concur with the statistical findings. The gray squirrels in the upper Mississippi River, the Rock River, and the upper Illinois River have a frequent occurrence of partial melanism, which is indicative of the northern subspecies. Biochemical tests of selected samples of gray squirrels were not beneficial because no differences were detected.

The gray squirrel that occurs in the northern portion of Illinois is apparently the northern subspecies. This subspecies, often in a completely melanistic phase, was common throughout southern Michigan in the 1800's. Near the turn of the century, settlers had cut the dense forests which held the gray squirrels. The timber then became farm woodlots interspersed with open fields--prime fox squirrel habitat. In less than 30 years, fox squirrels spread over the entire lower half of the southern peninsula of Michigan as most of the gray squirrels were eliminated. We hope that the fate of the gray squirrel in northern Illinois is not the same.

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Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Poor nest success on the sanctuaries at Bogota for the past 4 years has been attributed to nest destruction by mammalian predators (MWRL 19(7):3). Trapping by project personnel has had no noticeable effect in reducing nest predation (MWRL 19(7):4). Development of "predator-resistant" nest cover (MWRL 18(3):2) offers another possible way to alleviate nest predation. If such cover exists, we need to be able to distinguish it before we can begin to establish it in other than an accidental fashion. Therefore, a more definitive technique of describing nest cover was employed this year.

The technique used involves taking point samples at random locations with a small diameter rod graduated in centimeters. The rod is placed vertically in the vegetation and the maximum height of vegetation and the height of every strike by vegetation on the rod are recorded. Thus, height and density (based on the frequency of strikes in each height class) of vegetation can be evaluated with respect to density and success of prairie chicken nests.

In February and March, prior to nest initiation, all fields on the Yeatter, Field, McGraw, and Donnelley sanctuaries, and selected fields on other sanctuaries, were sampled using the above technique. In July and August, the same technique was used at individual nest sites. In this case, all samples were taken within 2 meters of the nest.

In preliminary analyses of the data for fields, it appears that differences are discernible between fields subject to different management techniques (Table 1). Due to inadequate samples in some categories, we cannot yet evaluate these data statistically.

We hope that subsequent sampling and analysis will enable us to define optimum nest cover for both nest density and nest success.

Table 1. Vegetative structure of fields subject to different management techniques, Jasper County Prairie Chicken Sanctuaries, 1976.

Management	Mean Maximum Height (cm)	Mean Height (cm) (all strikes)	Mean Percent Occurrence (density)
Unmowed	78.4	13.0	12.5
Mowed			
Rotary mower (weeds)	35.1	8.9	13.8
Sickle bar (hay)	42.4	14.1	7.8
Combine (seed)	39.4	10.7	16.7

MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

November, 1976

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Manipulation of Pheasant Habitat

R. E. Warner

As in recent years, hunting pressure on the Sibley Study Area (SSA) and Ford County Management Unit (FCMU) was light during the opening weekend (13-14 November 1976) of the pheasant season. Dry weather conditions that persisted through the weekend were favorable to the hunter. The soybean harvest, 90 percent of the corn harvest, and 70 percent of the fall plowing had been completed. When the pheasant season opened in 1975, the soybean harvest and 80 percent of the fall plowing had been completed and 95 percent of the corn had been harvested.

Although pheasant abundance on the study areas had declined from August 1975 to August 1976 (MWRL 19(9):1), less effort was required by hunters to harvest a cock pheasant in 1976 than in 1975. On the SSA, the 71 hunters interviewed were in the fields 301 man-hours and killed 31 pheasants (9.7 hours per bird). The hours of hunting required to kill a cock pheasant in 1962 through 1975 were 2.2, 2.7, 2.1, 8.0, 6.9, 8.1, 5.0, 4.3, 4.7, 3.4, 6.2, 7.4, 8.3, and 16.5, respectively.

On the FCMU, the 58 hunters interviewed tallied 295 man-hours afield to bag 49 pheasants (6.0 hours per bird). In 1974, 3.1 hours per bird were required on the opening weekend, and in 1975, 4.7 hours per bird.

Field time expended to harvest a pheasant on the SSA in 1976 was 1.6 times as great as that required by hunters on the FCMU (9.7 hours per bird on the SSA, 6.0 hours on the FCMU). In 1975, 3.5 times the effort to harvest a pheasant on the FCMU was required by hunters on the SSA (MWRL 18(11):1). The greater hunter success experienced during the opening weekends on the FCMU in 1975 and 1976, compared with the SSA, reflects the higher pheasant densities censused on the FCMU in the fall in comparison with the SSA control area over the past 2 years (MWRL 18(9):1).

Although numbers of pheasants declined on both study areas in 1976, from 1975, hunter success on the areas in 1976 compared with 1975, do not largely reflect this trend. On the SSA, the decrease in the time required to harvest a pheasant in 1976 over 1975 is attributed to the fact that corn harvest and fall plowing were less advanced in 1976 than in 1975. As opening day progressed in 1975, birds were scattered from permanent cover to plowed ground, thus limiting the availability of birds to hunters. This year, most farms had some unplowed corn stubble in which pheasants remained accessible to hunters throughout most of the opening weekend. On the FCMU, the slight

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The University of Chicago Library is pleased to announce the acquisition of a new volume of the *Journal of the History of Art*, published by the Society for the History of Art, London. This volume, which is the first of a new series, contains a number of articles on the history of art in the 19th century. The articles are written by some of the leading authorities in the field, and are of a high standard of scholarship. The volume is a valuable addition to the library's collection of books on the history of art.

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increase in time that was required to bag a pheasant in 1976, compared with 1975, is indicative of the diminished pheasant population this fall. This downward trend would presumably have been greatly accentuated had fall plowing been as extensive as in 1975.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Twenty-eight fox squirrels were shot during the hunting season of 1975 from three adjacent large areas of timber in Fayette County in south-central Illinois. Fayette County is moderately cultivated, corn, soybeans, and wheat being the major crops. Areas of timber and pasture are still common. The fox squirrels collected were analyzed for pesticides.

This sample of squirrels was separated into five groups: adult females lactating, adult females not lactating, adult males, subadult females, and subadult males. The squirrels were analyzed for DDE, dieldrin, PCB's, and other pesticides.

The concentrations of pesticides found in the specimens were low. Only DDE, a residue of DDT, and dieldrin were detected. Only 3 of the 28 individuals contained dieldrin, and the range of dieldrin concentrations was 0.0005 to 0.0023 ppm. However, a surprising number (25) of the 28 specimens contained DDE residues. The DDE concentrations ranged from 0.0008 ppm to 0.0195 ppm, with an average of 0.0037 ppm for the 25 squirrels in which DDE was detected. The highest concentration of DDE was found in the adult female lactating group, which had an average value of 0.0053 ppm, whereas the adult female nonlactating group had the lowest average concentration, 0.0023 ppm. The remaining groups had concentrations approximating the average concentration for all squirrels, 0.0037 ppm of DDE.

The probable method of uptake of DDE and dieldrin by fox squirrels is through their diet. Pesticides wash from agricultural fields into small creeks and streams. Mast-producing trees probably absorb water containing the pesticides. The trees may store the pesticides in their seeds, where they become available to squirrels. Considering that the lactating adult female group had the highest concentration of DDE, it is possible that nursing female squirrels may pass pesticides through their milk to their young. DDE and dieldrin are apparently so widespread throughout our environment that they even occur in fox squirrels living in areas less intensively cultivated than east-central and other parts of Illinois.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

The cash-bid procedure was used in 1975 and 1976 to manage the state-owned prairie chicken sanctuaries, which include 567 acres or 36 percent of the total sanctuary acreage. Leases were renewed with the same five

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lessees for the crop years of 1977-78. Cropping schedules and estimates for determining fair bid fees for the next 2 years were determined by this project. The Property Management Unit of the Land Acquisition Division then handled the typing, signing, and mailing of the new leases.

One advantage to the cash-bid procedure used by the state is the elimination of the need for documenting the state's share of crop yields, income, and expenses by procuring elevator receipts, weight tickets, and fertilizer and herbicide bills. Also, each farmer receives a written cropping schedule, covering the 2-year lease period plus the subsequent 2 years, for each field on the sanctuaries. Theoretically, repeated contacts with farmers should not be necessary.

Harvesting of redtop and timothy seed and hay mowing are the primary operations used to manage nest cover on the sanctuaries. Relatively small acreages of soybeans, wheat or oats, and red clover are permitted for the purpose of renovating old sods and providing booming grounds. Additional operations added to the new leases included mowing for weed control, seeding redtop and red clover, and top-dressing grass seed and hay meadows with fertilizer, all of which add to the lessee's expenses. It is hoped that these added operations by lessees will reduce the management tasks normally performed by project personnel or handled by way of contractual service vouchers.

Although prairie farmland in Jasper and Marion counties is commonly cash-renting for \$60.00 to \$90.00 per acre, cash bids on the state-owned sanctuaries ranged from \$0.133 to \$11.00 per acre for the crop years of 1975-76 and from \$0.50 to \$2.50 per acre for the crop years of 1977-78. Bid fees for management operations on the sanctuaries are necessarily low, mainly because of the uncertainties of redtop seed farming and because lessees are assessed for taxes on harvested acres. For example, due to drought conditions this summer, yields of redtop seed averaged about 30 pounds per acre and market prices for redtop seed averaged about \$0.50 per pound. This income of \$15.00 per acre covered harvesting expenses and left nothing to cover (1) tax payments, which in 1976 averaged \$6.74 per acre, or (2) the cash-bid fees mentioned above. The bid fees should be low for these reasons. Also, the primary objectives of the cash-bid approach should be to accomplish as many of the necessary management operations as possible in order to reduce (1) the man-hours spent by project personnel on management and (2) additional costs to the Division of Wildlife Resources.

MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

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Manipulation of Pheasant Habitat

R. E. Warner

In the 4 years (1973-76) in which pheasant nest studies have been conducted on the Ford County Management Unit (FCMU), an estimated average of 44 percent of all successful nests on the area were hatched in seeded roadsides. Therefore, roadside mowing prior to the prescribed mowing date of 1 August can destroy or prevent the establishment of a substantial portion of pheasant nests in the FCMU and thus reduce the benefits that seeded roadsides afford the pheasant population. In view of early roadside mowing, the phenology of the hatch on FCMU roadsides is an important consideration. Approximately 12 percent of the successful nests are hatched on FCMU roadsides by mid-June, 81 percent by mid-July, and 97 percent by 1 August (Table 1).

The percentage of roadsides mowed prior to the delayed mowing date of 1 August has been emphasized as a relative index of roadside mowing patterns from year to year (MWRL 19(8):1). These indices of mowing phenology, 1970-76, are listed in Table 2. Although supplying relative information regarding mowing patterns on the FCMU, these figures do not specify when roadsides were actually mowed. Determining more specifically than the 1 August figure (Table 2) when roadsides were mowed is significant because the nesting potential of roadside vegetation is diminished in direct accordance with how early roadsides are first mowed (Table 1). For example, mowing 15 July would not be as detrimental to overall nesting activities as mowing 15 June.

In order to determine more precisely the extent to which annual variations in mowing affect the potential of seeded roadsides as nest cover, a method of calculation was performed that accounts for the phenology of the hatch when roadsides were mowed annually and the amount of continued nesting activity that could have been expected if all roadsides on the FCMU were left unmowed through 1 August. For each 15-day period, 1 June-31 July, the percentage of nests hatched during the period (4-year averages for the phenology of hatch are shown in Table 1) was multiplied by the percentage of FCMU roadsides remaining unmowed through that 2-week interval. The calculations performed for the periods were then summated for each year. This summation provided an index of the percentage of the potential nesting activity annually realized on FCMU roadsides (Table 2); the maximum potential of roadsides for nesting assumes that no roadside mowing occurred prior to 1 August.

The calculations in Table 2 reveal that in years when early roadside mowing was relatively extensive, as in 1975 and 1976, recruitment to the fall pheasant population from hatched roadside nests was not curtailed as much as

1. The first part of the report is a summary of the work done during the year.

2. The second part of the report is a detailed account of the work done during the year.

3. The third part of the report is a summary of the work done during the year.

4. The fourth part of the report is a summary of the work done during the year.

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the early mowing index (MWRL 19(8):1, Table 2) suggests. The number of hatched roadside nests annually eliminated by early mowing will be considered in next month's newsletter.

Table 1. Phenology of the hatch of pheasant nests on FCMU roadsides, 1973-76.

	June				July			
	7	15	21	30	7	15	21	31
Percentage of nests hatched by above date	3.5	12.1	27.6	48.3	67.3	81.0	90.5	96.6

Table 2. Percentage of roadsides unmowed through 1 August and percentage of roadside nesting potential realized, FCMU, 1970-76.

	Year						
	1970	1971	1972	1973	1974	1975	1976
Percentage of roadsides unmowed through 1 August ($\bar{X} = 76.4$)	71.9	81.0	78.4	89.0	87.0	63.0	64.4
Percentage of nesting potential realized ^a ($\bar{X} = 82.5$)	88.3	86.4	83.6	93.4	77.1	72.8	75.8

^a Annual percentage of nesting potential realized equals the summation of the percentage of total nests hatched on roadsides during the period X the percentage of roadsides unmowed through the period for four periods ending 15 June, 30 June, 15 July, and 31 July.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

Food and the availability of sites for nesting are probably the most important limiting factors in a wild squirrel population. However, there are limits imposed on population size by the social relationships among members

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of any squirrel population. Fox squirrels appear to have what is known as a linear social hierarchy, with adults dominant over juveniles and males usually dominant over females. Unlike gray squirrels, which often reach population densities that necessitate large-scale emigrations when food supplies fail, fox squirrels seem to control their density through an annual emigration of juveniles, usually in early summer or in autumn. Thus, fox squirrel populations that are not subject to heavy and sustained annual harvests by hunters are typically stable in size from year to year and are composed mostly of adult squirrels.

This is the case for our two study areas in Vermilion County, Illinois, where we are testing the effects of artificial nest boxes on a fox squirrel population.

What happens when more shelter is provided for a squirrel population that presumably is utilizing all suitable existing tree dens? Will the constraints of food supplies and the existing social structure allow for an increase in population size? It seems reasonable to suppose that added adequate shelter in the form of nest boxes should benefit the subordinate juvenile segment most, at least initially.

Nest boxes provide more protection from predators and inclement weather than do leaf nests. However, we were without knowledge of the existing social structure when we placed nest boxes in the study areas; thus, at some locations leaf nests may be utilized instead of den boxes because the leaf nests are sited near the centers of an individual squirrel's home range, where conflicts with other squirrels would be minimized. This factor may be particularly important for the subordinate juveniles.

Thus far, nest boxes seem to be more important to juvenile squirrels than to the adult population. We have checked nest boxes for squirrel occupancy for three winters on our study areas and have found proportionately more juvenile squirrels present than would be expected on the basis of our fall livetrapping. We found that 41.7 percent (20/48) of the squirrels captured in boxes were juveniles, whereas only 27.4 percent (52/190) of the population that we livetrapped was comprised of juvenile squirrels. For adults, 25.0 percent (12/48) of the box captures were females and 33.3 percent (16/48) were males. We found 36.3 percent of our livetrapped samples (69/190) to be adult males and females (same percentage for both sexes). Thus, nest boxes appear to attract adult males in about the same proportion as they exist in the population. The boxes appear to attract proportionately fewer adult females and proportionately more juveniles than exist in the wintering squirrel population.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

The problems associated with the establishment of pheasants on the prairie chicken sanctuaries may be listed as follows:

The first part of the report deals with the general situation of the country. It is a very interesting and informative study of the country's development. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country's development.

The second part of the report deals with the economic situation of the country. It is a very interesting and informative study of the country's economic development. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country's economic development.

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1. Aggressive harassment of prairie chickens by pheasant cocks (MWRL 19(2):2-3).
2. The threat of interbreeding, resulting in sterile hybrid progeny.
3. Probable competition for space on the sanctuaries.
4. Parasitism of prairie chicken nests (MWRL 19(3):3).
5. Possible abandonment of prairie chicken nests, due to pheasants (MWRL 19(8):3-4).
6. Attraction of hunters to prairie chicken sanctuaries.
7. Adverse public relations due to efforts by project personnel to control pheasants on sanctuaries.

An effort was made during the spring of 1976 to reduce pheasant numbers on the sanctuaries by livetrapping in crowing territories, using live game-farm pheasants as bait. The plan was to transplant pheasants to Sam Parr State Park, about 6 miles from the nearest sanctuary, as an aspect of local public relations. The live traps involved two modified versions of the Stoddard cock-and-hen trap that is effective for bobwhite quail during the breeding season. To our knowledge, this technique has not been tried on pheasants.

Six cock pheasants and six hens were supplied for this experiment by the Des Plaines Game Farm on 1 April 1976.

Trapping was attempted during 6 days in April, 2 days in May, and 1 day in June, representing a total of 120 trap-hours. Usually, one to four traps were baited and set from about 0430 hours until about 1100 hours. On one occasion six traps were set about 0430 hours and left out overnight until about 1000 hours the next day. Only one capture was made and this bird had escaped by the time the trap was checked. In this instance, the wild cock pheasant escaped from one of two tip-top traps set on each side of an elevated cage containing a bait hen.

Thus, our first attempt at this approach to livetrapping pheasants was disappointing. At this time we are undecided whether to try the technique during one more spring. In contrast to the prairie chicken population, which has shown three consecutive declines since 1973, annual changes in numbers of crowing cock pheasants at Bogota have shown either increases or stability during the same period. Also, the rate of prairie chicken nests parasitized by pheasants increased to 8.9 percent in 1976--the highest recorded since 1970 when the first case was discovered. It is hoped that some alternative to shooting and the associated adverse public relations can be devised for pheasant control on the prairie chicken sanctuaries.

The first part of the paper is devoted to a general discussion of the problem. It is shown that the problem is of great importance in the theory of the differential equations of the second order. The second part of the paper is devoted to the study of the properties of the solutions of the differential equations of the second order. It is shown that the solutions of the differential equations of the second order are of great importance in the theory of the differential equations of the second order.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

January, 1977

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Manipulation of Pheasant Habitat

R. E. Warner

Pheasant nesting studies conducted on the Ford County Management Unit (FCMU) from 1973 to 1976 reveal that seeded roadside cover, although comprising only 1.5 percent of the land area, has been the principal nesting habitat for pheasants in 3 of the past 4 years. However, the full potential of the roadsides as nest cover has not been realized. Some degree of early mowing (prior to the prescribed date of 1 August) has been documented annually for roadsides on the FCMU. The extent to which early roadside mowing affects nesting in roadside vegetation was reported in last month's newsletter (MWRL 19(12):1-2); the realized potential for nesting on roadsides ranged from 72.8 percent in 1975 to 93.4 percent in 1973 (MWRL 19(12):2, Table 3).

This month's newsletter quantifies the number of additional nests and chicks that would have been produced on FCMU roadsides, 1973-76, had no early roadside mowing occurred. These estimates are derived from calculations using (1) the percentage of nesting potential realized, (2) the number of nests hatched on roadsides in the FCMU, and (3) the number of chicks per nest hatched in roadside vegetation. If no early mowing had occurred on the FCMU over the past 4 years, an average of 6.7 additional pheasant chicks per section would have hatched in 1973, 22.1 in 1974, 6.0 in 1975, and 6.6 in 1976 (Table 1, F).

It is estimated that in 1975 an average of 56.9 chicks were hatched per section in nonrow crop cover. Thus, the 6.6 additional chicks per section that would have hatched if no early mowing had occurred would represent a substantial addition (11.6 percent) to the number of pheasants hatched on the FCMU last summer.

Table 1. Additional pheasant chicks that would have hatched on roadsides (per section) if no early mowing (prior to 1 August) had occurred on the FCMU, 1973-76.

	Year			
	1973	1974	1975	1976
A. Percentage of nesting potential realized on FCMU roadsides ^a	93.4	77.1	72.8	75.8

NATURAL HISTORY SURVEY

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WASHINGTON, D. C., MAY 1, 1914

TO THE DIRECTOR

PLANT INDUSTRY DIVISION

FROM THE DIRECTOR

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RE: [Illegible text]

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B. Nests hatched on roadsides per section	11.9	9.3	2.0	3.6
C. Nests hatched on roadsides (per section) if no early mowing had occurred (A X 100 ÷ B)	12.8	12.1	2.7	4.7
D. Additional nests hatched on roadsides (per section) if no early mowing had occurred (C - B)	0.9	2.8	0.7	0.9
E. Average clutch size per nest hatched on roadsides	7.4	7.9	8.5	7.3
F. Additional chicks hatched on roadsides (per section) if no early mowing had occurred (D X E)	6.7	22.1	6.0	6.6

^a From MWRL 19(12), Table 2.

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

In the last monthly newsletter (MWRL 19(12):2-3), we discussed the rates of capture for various sex- and age-classes of fox squirrels captured in nest boxes during winter. We captured about equal numbers of adult males, proportionately fewer adult females, and proportionately more juveniles in nest boxes than were present in the squirrel population, as revealed by live-trapping. Nest boxes may be considered surplus denning sites (compared with natural dens and leaf nests) to be used more by subordinate squirrels than by the socially dominant adult squirrels.

Do nest boxes really benefit individual squirrels? Nest boxes should provide better protection from predators and inclement weather than leaf nests. Thus far, our study shows that juveniles benefit more than adults from use of nest boxes. We found that fall-to-spring survival of juveniles using nest boxes (14/19 = 73.7 percent) was much higher than survival of juveniles that did not use boxes (11/25 = 44 percent) during the winters of 1972-73, 1973-74, and 1975-76. Fall-to-spring survival of adult males was similar whether they used nest boxes (13/16 = 81.3 percent) or used natural dens or leaf nests (38/49 = 77.6 percent). Fall-to-spring survival of adult females was also similar, 70.0 percent (7/10) for those using nest boxes and 82.7 percent (43/52) for those not using boxes.

Nest boxes are usually vacated by adult squirrels each summer, when they seek the cooler, less parasitized leaf nests for shelter. Thus, unoccupied nest boxes are usually available each fall for use by juveniles, who would otherwise have to use leaf nests or disperse from the area. The favored tree cavities are probably nearly all usurped by adult squirrels each year.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Administrators in wildlife management agencies often need to know what population density a wildlife species can attain on a given acreage of managed habitat and how soon newly established habitat will begin to produce. After 14 years of studying the population responses of prairie chickens to habitat management on gradually acquired sanctuaries, we feel we can now provide some answers to those questions.

Sanctuaries in Jasper County were acquired in scattered tracts in eight sections from 1962 to 1973. These tracts were purchased on the basis of availability, proximity to known prairie chicken range, and cover condition. Nearly all tracts required grassland establishment. It is now apparent that initial usage of these individual units was dependent on the unit's distance from an established booming ground at the time of acquisition and initial management. The Yeatter-Field-McGraw sanctuary complex (232 acres) was within 0.2 mile of an established booming ground when the first purchase of 77 acres was made, and contained a booming ground within 1 year after establishment of nest cover. At the other extreme, the McCormack 80-acre sanctuary was 1.5 miles from the nearest booming ground and did not have a booming ground on it until 7 years after establishing nest cover. A significant, positive correlation ($r = 0.948$, $P < 0.01$) was found between distance to an established booming ground and number of years until occupancy by prairie chickens. Apparently, land purchased for management of prairie chickens will be occupied by chickens within 1 year (after establishment of nest cover) if less than about 0.25 mile from an established booming ground, within 3 years if within 0.5 mile, and within 5 years if within 1.0 mile. Such a delay in use is surprising for a highly mobile species like the prairie chicken.

The sanctuaries at Bogota have maintained an average of 20 prairie chicken cocks per 100 acres of nest cover over the last 10 years. The Yeatter-Field-McGraw complex has maintained the highest population of all the sanctuary units. At its peak, this unit held 69 cocks per 100 acres of nest cover in 1972. We believe this density to be the highest ever recorded in the range of the prairie chicken. At this density, we could theoretically have about 500 cocks on the sanctuaries at Bogota during a population high.

Sanctuaries situated in areas of traditional use by prairie chickens (Yeatter, Field, McGraw, Donnelley, and Walters) apparently can maintain 20 cocks per 100 acres of nest cover in the worst years. Peripheral sanctuaries (C. McCormick, Otis, Fuson, J. McCormack, Mark 17 and 40, and Galbreath) have not shown this ability and have dropped to as low as 2 cocks per 100 acres. It is hoped that with improved nest cover on the recently acquired sanctuaries, we can eventually maintain 20 cocks per 100 acres of nest cover on all sanctuaries. At least 700 acres of fair-to-good nest cover are available annually on the 1,001-acre sanctuary system in Jasper County. Thus, a spring population containing at least 140 cocks may be a realistic long-term goal at Bogota if the sanctuary acreage remains the same.

THE HISTORY OF THE UNITED STATES

The history of the United States is a story of growth and change. From the first settlers to the present day, the nation has evolved through various stages of development. The early years were marked by exploration and the establishment of colonies. The American Revolution led to the birth of a new nation, and the subsequent years saw the expansion of territory and the growth of industry. The Civil War was a pivotal moment in the nation's history, leading to the abolition of slavery and the strengthening of the federal government. The 20th century brought significant changes, including the rise of the United States as a world power and the challenges of the Cold War. Today, the United States continues to shape the world and its future.

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cat.
MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

February, 1977

Vol. 20, No. 2

Manipulation of Pheasant Habitat

R. E. Warner

Several censusing activities annually conducted on the Sibley Study Area (SSA, control) and the Ford County Management Unit (FCMU, seeded road-sides) provide information on the status of the pheasant populations on these areas. These efforts include roadside counts and cock call counts in spring, brood counts and nest studies in summer, hunter harvest surveys, and sex ratio counts and aerial counts in winter. With the exception of the aerial counts, these methods reflect only relative fluctuations in pheasant abundance. The aerial census, however, enables the observer to determine, with comparative accuracy, the number of pheasants in a specified area. Therefore, these counts are vital to understanding the dynamics of the pheasant populations on the SSA and FCMU. To conduct an accurate count from a helicopter, the plowed fields must be completely covered with snow so that pheasants are readily visible from the air. Only four times since 1962 have snow cover conditions been favorable for making helicopter counts.

The heavy snowfall that occurred last month (January 1977) facilitated an aerial census, and with the assistance of personnel from the Illinois Department of Conservation (IDC), counts were completed for the SSA, FCMU, and three areas recently or soon to be seeded by the IDC--Harwood Township (Champaign County), Anchor Township (McLean County), and Prairie Green Township (Iroquois County). The findings from these and the three earlier counts are listed in Table 1. The numbers of pheasants listed in the table are considered to be minimal, since it is possible that some pheasants were not observed and counted from the helicopter. In addition, some of the pheasants hatched in a particular area may live outside the area during the winter months--principally because they have found more attractive winter cover elsewhere. This phenomenon may have occurred on the FCMU, for example, where large numbers of pheasants were observed near grassy or woody cover located 0.5 to 1.5 miles from the perimeter of the area.

From nonaerial censusing activities conducted in 1967, we know that 10 years ago--prior to the roadside seedings on the FCMU--pheasant abundance on that area was similar to that on the SSA. Subsequently, the last two aerial counts (December 1973 and January 1977) revealed significantly ($P < .05$) greater numbers of pheasants on the FCMU. Both areas, however, experienced dramatic declines in pheasant abundance over the 3 years since the aerial count in December 1973. Pheasant numbers on the FCMU declined 73 percent

NATURAL HISTORY SURVEY

MAR 7 1977

(111 per section to 30 per section) over this period, and numbers on the SSA declined 86 percent (62 per section to 9 per section) (Table 1). The decline in pheasant abundance on both areas is related primarily to the continued elimination of habitat crucial to the pheasant's reproductive and overwintering activities. This habitat destruction is the result of expanded corn and soybean acreages and associated clean farming practices.

Pheasant abundance, as documented by the aerial census in January 1977, is also listed in Table 1 for the three townships scheduled for seedings. Aerial counts made in future years, after the establishment of roadside seedings in these areas, will enable us to compare the preseeding with the postseeding abundance of pheasants.

Table 1. Pheasant abundance as determined by winter aerial census.

Area (County)	Number of Sections Censused	Pheasants Counted per Section			
		February 1963	March 1965	December 1973	January 1977
Anchor (McLean)	16	--	--	--	8
Harwood (Champaign)	16	--	--	--	5
Prairie Green (Iroquois)	16	--	--	--	26
FCMU (Ford)	20	--	--	111	30
SSA (Ford)	36 1/4	112	47	62	9

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

As noted in the January research letter (MWRL 20(1):2), nest boxes seem to benefit juvenile fox squirrels to a greater degree than adult fox squirrels. Is the benefit due to increased production (more squirrels raised in boxes than in leaf nests and tree cavities) or to the better shelter provided by nest boxes during the postweaning period?

We have no evidence as yet that nest boxes are increasing the production of young. Production of weaned young has been nearly identical on our boxed areas (5-year average, juveniles = 25.4 percent, N = 366 total squirrels) and our unboxed areas (5-year average, juveniles = 26.4 percent, N = 303 total squirrels).

Both of our 65-acre study areas are only lightly hunted each fall and are populated by stable, mostly adult populations of fox squirrels. The

addition of nest boxes has not significantly changed the age structure on either study area. In particular, there seem to be remarkably stable numbers of adult females on both study areas. Over a 5-year period the number of adult females found each year has varied only from 25 to 32 on Danville A; on Danville B, from 16 to 20.

Nest boxes have also had little effect on the annual survival of adult fox squirrels. Fall-to-fall recovery rates (squirrels tagged and later recovered) for adult males have averaged 81.5 percent (128/157) with boxes present and 80.6 percent (108/134) without boxes. For adult females, annual recovery rates were 81.1 percent (129/159) with boxes present and 83.7 percent (118/141) without boxes. Fall-to-spring recovery rates for adult squirrels on boxed and unboxed areas were also similar.

For juvenile squirrels, however, nest boxes increase recovery rates for both sexes. The annual recovery rate for subadult female fox squirrels was significantly higher ($P < 0.05$) on the boxed areas than on the unboxed areas. The recovery rate for juvenile males on the boxed areas was higher than for juvenile males on the unboxed areas and approached a significant difference ($0.05 < P < 0.10$).

Nest boxes apparently provide a predator-proof, weather-resistant shelter not provided by leaf nests. Most of the tree cavities suitable for sheltering squirrels are taken over by adult squirrels each fall. Unlike gray squirrels, which often den in family groups, adult fox squirrels usually den alone and thus utilize most of the available tree cavities.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

In the last monthly newsletter (MWRL 20(1):3), we discussed (1) the time interval between the establishment of nest habitat and its initial usage by prairie chickens, and (2) the densities of prairie chickens attained, on the seven sanctuary units in Jasper County. Initial use was based on the establishment date of booming grounds either on or within 0.25 mile of the various units. Densities were based on the counts of male prairie chickens on the booming grounds.

In contrast to the 1,001 acres of sanctuaries acquired between 1962 and 1973 in Jasper County, 560 acres of sanctuaries were acquired in Marion County between 1967 and 1974. Thus, from the standpoints of acreage and time, our experience in documenting responses of prairie chickens to habitat manipulations is less in Marion County than in Jasper County. Although Marion County now has four units ranging in size from 100 acres to 160 acres, only three units have been present long enough (at least 8 years) to test responses by prairie chickens.

Initial responses to the three units in Marion County occurred within 1 to 3 years and appeared to be correlated with the distance of the units from

established booming grounds, as was the case in Jasper County. Response to the Illinois Natural History Survey Sanctuary occurred the same year the land was acquired (1967), but due largely to the presence of numerous feral and free-ranging dogs, only one to four male prairie chickens boomed on or near this tract during 6 of the last 10 springs. The Butler and Lacey sanctuaries were acquired in the spring of 1969. By 1971, prairie chickens were booming either on or within 220 yards of each tract. Densities over the past 6 years have averaged 10.0 cocks per 100 acres of nest cover on the Butler Sanctuary (160 acres), and 22.9 cocks per 100 acres of nest cover on the Lacey Sanctuary (100 acres, plus 40 acres added in 1971). The average density of 10.8 cocks per 100 acres of nest cover for all sanctuaries in Marion County over the past 6 years is about half the density of 20.1 cocks per 100 acres attained in Jasper County. However, the densities of prairie chickens in both counties are roughly 4 to 10 times higher than estimates of densities in the neighboring states of Wisconsin and Missouri. Preservation efforts for prairie chickens in these states have many similarities to our program in Illinois.

The 100-acre Loy tract acquired in December 1974 by The Nature Conservancy will add 75 acres of quality nest cover this spring to the sanctuary system in Marion County. Negotiations are also under way to add an 80-acre tract in Marion County. With these additions and the continued curtailment of the dog problem on the Survey Sanctuary, it is hoped that the densities of prairie chickens in Marion County will reach those attained in Jasper County.

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MONTHLY WILDLIFE RESEARCH LETTER

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Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

March, 1977

Vol. 20, No. 3

Manipulation of Pheasant Habitat

R. E. Warner

From 27 to 29 January 1977, winter storm conditions of unusual severity occurred in east-central Illinois and throughout most of the state. Moderate snowfall occurred late Thursday night and early Friday morning, 27-28 January. Winds gusting in excess of 50 mph prevailed Friday morning and temperatures dropped below -20 F in most of the prime pheasant range. Severe wind chill factors and blowing snow were recorded for Friday and Saturday, 28-29 January. After the severe winter blast, and with the assistance of biologists from the Department of Conservation, we collected 49 frozen pheasants from selected areas of study in Ford, McLean, and Iroquois counties.

To determine the cause of death and to evaluate the general condition of the frozen birds up to the time of mortality, the specimens were weighed and necropsies were performed. Weights of the 38 hens collected (17 were juveniles) averaged 957.5 g, and weights of the 11 cocks (7 were juveniles) averaged 1,293.4 g (Table 1). These weights are slightly below average for Illinois pheasants in January but do not represent a significant departure from the normal weight curves of winter pheasant populations in most Midwestern states. Thirty-nine (80 percent) of the 49 collected specimens were found to have substantial fat reserves, and 40 (82 percent) had food--principally corn and soybeans--in their crops. In general, the pheasants were in good condition up to the time of death. There was no evidence of nutritional stress that would have suggested an inadequate food supply of scattered cash grains, inability to scratch through plowed earth or snow to find food, or feeding activities suppressed for an extended period of time by extremely cold temperatures. Nearly all of the collected specimens were found to have deposits of ice in their throats and beaks, and in some cases entire heads were packed with ice or snow. These findings are documented signs of pheasants that succumb from exposure to extreme winter conditions of wind, temperature, and precipitation. The severe conditions experienced from 27 to 29 January are uncommon in east-central Illinois and therefore rarely limit pheasant abundance in this state's prime range.

The extent of the storm-related mortality can be tentatively estimated. On the 16-square-mile Ford County Management Unit (FCMU), a prestorm helicopter census conducted 20 January 1977 showed an average of 30 pheasants per square mile (MWRL 20(2):2). After the storm, 31 of the 40 miles of roadway in the FCMU were driven in a search for dead pheasants. Twenty-seven frozen birds were visible to observers from the road. If all roads in the area had been passable, up to 7-10 percent of the pheasants counted in the aerial census may have been observed frozen from the roadway. Because the portion of the FCMU

on which frozen pheasants can be observed from the road is only a fraction of the total land area, it is estimated that perhaps 25 to 50 percent of the pheasants in this 16-square-mile area may have succumbed during the storm. When the spring census is conducted in ~~May~~, it will be possible to make a better assessment of the effects of this highly unusual winter on pheasant populations in the study areas.

Table 1. Weights of 49 pheasants found frozen in Anchor Township (McLean County), Prairie Green Township (Iroquois County), and the Ford County Management Unit (Ford County), after the severe winter storm of 27-29 January 1977.

Sex	Age	Number	Average Weight (in grams)
Hens	Adult	21	966.3
	Juvenile	17	946.7
	Total	38	957.5
Cocks	Adult	4	1345.3
	Juvenile	7	1263.7
	Total	11	1293.4

Ecology and Management of Squirrels

C. M. Nixon,
S. P. Havera

If nest boxes improve the survival rate for juvenile fox squirrels, as reported in the last newsletter (MWRL 20(2):1), then total populations should increase on the area with nest boxes.

As shown in Table 2, the mean estimates of population size for areas with and without nest boxes do not differ very much but are higher when nest boxes are present. We also captured more squirrels on both areas when boxes were present (Table 2).

Table 2. The mean number of squirrels captured and the mean estimates of population size for two 65-acre study areas, one with nest boxes, the other without boxes.

	Mean Number of Squirrels Livetrapped	
	Danville A	Danville B
Before boxes	54.0	28.6
Boxes present	54.8	33.0
After boxes	41.3	----

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The first part of the report is devoted to a description of the experimental conditions. The second part contains the results of the measurements. The third part is a discussion of the results. The fourth part is a conclusion. The fifth part is a list of references.

Table 1			
Time	Temperature	Pressure	Volume
1.0	20.0	1.0	1.0
2.0	20.0	1.0	1.0
3.0	20.0	1.0	1.0
4.0	20.0	1.0	1.0
5.0	20.0	1.0	1.0
6.0	20.0	1.0	1.0
7.0	20.0	1.0	1.0
8.0	20.0	1.0	1.0
9.0	20.0	1.0	1.0
10.0	20.0	1.0	1.0

Table 2

The second part of the report is devoted to a description of the experimental conditions. The second part contains the results of the measurements. The third part is a discussion of the results. The fourth part is a conclusion. The fifth part is a list of references.

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Table 3			
Time	Temperature	Pressure	Volume
1.0	20.0	1.0	1.0
2.0	20.0	1.0	1.0
3.0	20.0	1.0	1.0
4.0	20.0	1.0	1.0
5.0	20.0	1.0	1.0
6.0	20.0	1.0	1.0
7.0	20.0	1.0	1.0
8.0	20.0	1.0	1.0
9.0	20.0	1.0	1.0
10.0	20.0	1.0	1.0

Mean Estimates of Population Size

	Regression	MLE	Regression	MLE
Before boxes	121.8	124.8	75.8	107.0
Boxes present	132.6	131.6	88.2	96.3
After boxes	126.0	116.6	----	-----

The data are complicated by the partial failure of the tree seed crop in the fall of 1973. It appeared that the squirrel population on Danville A, the area with nest boxes present in 1973, was increasing from pre-nest box levels. The mean population estimate was 138 squirrels in the fall of 1973 but declined to 98 squirrels in the spring of 1974. On Danville B, where nest boxes were not present, the squirrel population declined even more, from about 100 squirrels in the fall of 1973 to an estimated 53 in the spring of 1974.

Adequate shelter is important to the well-being of the squirrel population, but an adequate food supply must be available each fall for squirrels to benefit from nest boxes. The higher recovery rate for juvenile squirrels on the boxed area for the 1973-74 fall-to-spring period, compared with that on the unboxed area, means that nest boxes can partially offset the detrimental effects of a seed crop failure. It seems reasonable to attribute this higher survival rate of juveniles to an improved heat-energy budget for fox squirrels in nest boxes compared with juveniles forced to spend the winter in leaf nests. Adult squirrels usually take possession of the better tree cavities each fall and prevent the subordinate juveniles from using them.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Recent monthly newsletters have dealt with the problems of predation on prairie chicken nests and parasitism of prairie chicken nests by pheasants. Within the past 4 years, these two factors have become most serious from the standpoint of the declining prairie chicken numbers on the Bogota Study Area in Jasper County. A similar problem, involving free-ranging and feral dogs on several of the sanctuaries in Jasper and Marion counties, has also been an obstacle to successful management of prairie chickens, but for a much longer period.

Free-ranging dogs have long presented a problem in the management of the 140-acre McCormick Sanctuary at Bogota. Five active farmsteads (mainly two of them) within 0.25 mile of this tract continue to be the source of these dogs. Recently a house trailer was added to a nearby farmstead; thus, the number of dogs will probably increase. The McCormick Sanctuary has not maintained a stable booming ground, despite an apparent high potential for such, since its acquisition in 1966. Overall, the sanctuaries at Bogota have maintained an average of 20 chicken cocks per 100 acres of nest cover over the last 10 years. By contrast, the McCormick Sanctuary has averaged only 5.9 cocks per 100 acres of nest cover,

on relatively unstable booming grounds. Likewise, success of prairie chicken nests on the McCormick Sanctuary has generally been lowest of all the sanctuaries at Bogota.

There are also six active farmsteads within about 0.25 mile of the 232-acre Yeatter, Field, and McGraw complex. The farmstead on the east side of this complex is the main source of dogs. Although densities of prairie chickens have remained highest (average of 41 cocks per 100 acres of nest cover) in this area, use by prairie chickens has become increasingly limited on the east side of the Field Sanctuary. One year, three young prairie chickens were found mauled, but uneaten, in this area--characteristic of having been killed by a bird dog.

In Marion County, response of prairie chickens to the Illinois Natural History Survey Sanctuary (160 acres) occurred the same year the land was acquired (1967), but due largely to the presence of numerous feral and free-ranging dogs, only one to four male prairie chickens boomed on or near this tract during 6 of the last 10 springs. Litters of feral dogs were found in abandoned woodchuck dens on three occasions on or near the Survey Sanctuary. On four instances we have had close calls with packs of feral or free-ranging dogs (or both) that gave every indication of attacking. Such packs have numbered as high as 12 dogs. Local farmers in Marion County have related similar experiences to us--and assisted in control of such dogs.

In general, however, control of dogs on the sanctuaries is difficult. We have repeatedly asked neighboring farmers to keep their dogs at home. After 12 years of such efforts this approach appears hopeless. Allowing dogs to range freely appears to be a social pattern we cannot hope to change. Shooting or trapping, or the threat of these, is definitely not the answer--except in the case of feral mongrels. Legal action against the offending dog owners is also generally inadvisable because of the need to maintain favorable public relations in the prairie chicken areas.

For the above reasons, we plan to try electric fencing on two sanctuaries at Bogota during nesting season this year. Electric fencing has been used to reduce predation on individual nests of sharp-tailed grouse (Pedioecetes phasianellus) and ducks in North Dakota. Also, a 2,000-m electric fence was effectively used to protect a nesting colony of sandwich terns (Sterna sandvicensis) from predation by red foxes in Scotland. Thus, it may be possible to control dogs and wild predators by the use of electric fences.

It may eventually be desirable to establish woven wire fences in combination with electrification on most of the sanctuaries. Continued trespass on the sanctuaries by coyote hunters in all-terrain vehicles, trail bikes, four-wheel-drive trucks, and even snowmobiles, also indicates that some kind of fencing should be a routine annual chore.

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Manipulation of Pheasant Habitat

R. E. Warner

In 1976, 41.8 acres of roadside plots on the Ford County Management Unit (FCMU) and 50.8 acres of graded roadsides (Ford County) seeded by the Department of Conservation were searched for songbird nests. Each roadside plot and graded roadside was searched once in June and again in late July or early August. All of these roadsides were seeded to brome and alfalfa, the plots on the FCMU in 1968 and the graded roadsides in 1972, 1974, or 1975. Nest densities averaged 1.12 nests per acre on FCMU plots and 0.94 nest per acre on the graded roadsides (Table 1). Of the 104 songbird nests found on roadsides, 90 (86.5 percent) were identified as nests of red-winged blackbirds.

With only 1 year's information on roadside nesting, it is not possible to evaluate the influences of the age of roadside vegetation (vegetative composition) on nesting of songbirds nor to determine the relative benefits, to songbird populations, of block seedings (FCMU) as compared with seeding graded roadsides scattered throughout east-central Illinois.

Table 1. Densities of songbird nests on seeded roadsides, 1976.

	<u>FCMU</u>	<u>Ford County Seeded</u>			
	1968	1972	1974	1975 ^a	
Total of seedings	47	40	8	9	104
Nests	41.8	41.7	9.1	9.9	102.5
Acres	1.2	0.96	0.88	0.91	$\bar{X} = 1.0$
Nests per acre					

^a The seedings of 1975 were not completely established; these plots were found to have less brome and more legumes and broadleaf weeds than the seedings made in 1968, 1972, and 1974.

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Ecology and Management of SquirrelsC. M. Nixon,
S. P. Havera

By human standards, the winter of 1976-77 was one of the worst in this century. Record low temperatures for much of December and January were accompanied by above-average snowfall and high winds.

Many people felt that such extreme weather conditions would decimate Illinois wildlife populations. In some parts of Illinois, ground-feeding birds, including the ring-necked pheasant, were hard hit by the severe winter. Yet for at least one species of wildlife, the fox squirrel, the winter of 1976-77 does not appear to have been too severe.

We examined 31 adult female fox squirrels during livetrapping conducted during early March in Vermilion County, Illinois. We found that 29 of these females (93.5 percent) were pregnant (2) or already nursing young (27). This rate of breeding is the highest we have found since we began trapping in Vermilion County in 1971.

We also found body weights to be within the normal range of early spring and the sarcoptic mange infestations to be lower than normal.

How was it that Vermilion County fox squirrels were able to withstand the severe weather so well? We believe that the answer lies with the above-average tree seed crops of 1976. There were bumper crops of white, post, and bur oak acorns over much of Illinois, allowing squirrels to accumulate fat deposits last fall prior to cold weather. Red and black oaks also produced bumper crops of acorns which, because they do not germinate until spring, provided squirrels with an abundant food supply all winter.

Fox squirrels in Illinois are dependent upon tree seed crops for most of their annual diet. The excellent condition of the Vermilion County fox squirrels this spring is testimony to the importance of an abundant and varied tree seed crop. The upland forests of Illinois, dominated by various oaks and hickories, provide an excellent food source if they are protected from fire and grazing and the crop trees are allowed to reach seed-bearing age. It is unfortunate that more and more forests in Illinois are not being maintained in seed-bearing condition, are often overcut, heavily grazed, burned, or even totally destroyed. Thriving forests of mixed species can sustain squirrel densities of 1-2 per acre and legal harvests of 2-3 per 5 acres. If our remaining 3+ million acres of forest were all equally flourishing, squirrel hunters could expect to increase their kill levels substantially over present harvests.

Assistant Project Leader S. P. Havera resigned effective 15 April to accept a position with the Natural History Survey's environmental research in the Section of Wildlife Research.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

The prairie chicken population on the Bogota Study Area was censused in the spring of 1977 for the 15th consecutive year. As in past springs, booming ground surveys were conducted along with supplementary observations made by visitors in blinds almost daily from 26 March through 18 April.

Counts made this spring (1977) yielded a total of 75 cocks, a decline of only 7.4 percent from the 81 cocks counted at Bogota in the spring of 1976. This count represented a fourth consecutive spring decline after the population's steady increase from the low point of 37 cocks in the spring of 1968. The highest count was 203 cocks in the spring of 1973.

The decline this spring was anticipated (MWRL 19(9):5) on the basis of the low rate of nest success (35.6 percent) the previous summer. However, the magnitude of the decline is less than was expected in view of the low nest success combined with an exceptionally severe winter. Apparently, brood survival was excellent last summer. Also, we have seen no evidence that the extreme cold and prolonged snow cover this winter had substantial detrimental effects on the population of prairie chickens at Bogota.

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1. The first part of the document is a letter from the Secretary of the Board of Directors to the Board of Directors. The letter is dated 10/1/1911 and is addressed to the Board of Directors. The letter is signed by the Secretary of the Board of Directors.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

May, 1977

Vol. 20, No. 5

Manipulation of Pheasant Habitat

R. E. Warner

One potential limitation to developing roadside vegetation as nest cover for pheasants is the possibility of initiating or intensifying the use of roadsides as travelways for mammalian species that prey at the nest sites. Thus, the benefits of managing roadside cover must be evaluated on the basis of rates of nest success and predation.

Information collected from nest studies of pheasants on the Sibley Experimental Roadsides (searched for nests from 1963 to 1972) and the Experimental Field (searched from 1966 to 1970) provides a way to compare nest success on the two types of areas--roadside (strip) and field (block). The Experimental Field, located in Germanville Township, Livingston County, was established in September 1965. The 24-acre rectangular field was divided into 40 0.6-acre plots; 10 were seeded in brome, 10 in brome-alfalfa, 10 in alfalfa-red clover, and 10 in timothy, orchard grass, brome, alfalfa, and red clover. For the purpose of comparing nest success and predation in the field versus the roadside setting, the Experimental Field is considered an entity. This consideration is feasible because phenology of nesting, and rates of predation, abandonment, and hatch did not differ significantly ($P > 0.05$) among vegetational plot types.

The Sibley Experimental Roadsides in Sullivan Township, Ford County, include plots seeded in 1962 to a mixture of timothy, orchard grass, brome, alfalfa, and red clover, as well as managed control plots adjacent to the seedings, left unmowed but not seeded. An average of 37.2 acres of roadsides were searched annually. Within a few years, the plant composition of the managed control plots closely approached that of the seeded roadside plots. Vegetation on the roadsides and in the field was dominated by brome grass.

During the period 1963-72, an average of 30.2 percent of the pheasant nests on the Sibley roadsides were successful. The average for 1966-70 was 32.0 percent. Over this same 5-year period, 32.5 percent of all established nests hatched in the Experimental Field. Thus, for the 5 years in which both roadsides and field were searched the overall success of nesting was nearly identical (Table 1). Closer evaluation of the data, however, reveals some important year-to-year trends.

No significant variation ($P > 0.05$) in the rate of nest success on the roadside plots was observed among the years 1963-72. In the Experimental Field, success varied significantly ($P < 0.005$) among the years 1966-70. It is an important fact that nest success was unusually high (61.5 percent) the

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first year after the seeding of the field. Although atypically high at first, the rate of nest success in the field progressively declined through the years, to the extent that only 7.1 percent of all nests hatched in 1970 (Table 1). As shown in Table 1, the annual decline in success of nesting in the Experimental Field is highly correlated with increased predation.

These findings suggest that predator activity increases from year to year in a field situation. If nesting had been evaluated in the Experimental Field for more than 5 years, it is likely that the decline in nest success would have been observed to level off. In contrast to the field, findings from 10 years of nest searches on the Sibley roadsides give no indication that predator activity intensifies with time for such strip cover. Of particular interest with reference to management, the data listed in Table 1 are evidence that over a period of several years, hatch rates on roadside (strip) cover are consistently higher than for a given field (block) setting.

Table 1. Fate of pheasant nests on Sibley Experimental Roadsides (37.2 acres) and Experimental Field (24.0 acres), 1963-72.

Year	Established Nests		Percent Successful		Percent Predation	
	Roadsides	Field	Roadsides	Field	Roadsides	Field
1963	87	--	27.6	--	37.9	--
1964	106	--	17.9	--	58.5	--
1965	85	--	27.1	--	49.4	--
1966	103	39	26.2	61.5	52.4	10.2
1967	70	85	24.3	31.8	60.0	29.1
1968	65	117	38.5	35.0	21.5	28.2
1969	54	92	40.7	27.2	33.3	39.1
1970	83	42	30.1	7.1	33.7	71.4
1971	99	--	23.2	--	51.5	--
1972	47	--	46.8	--	29.8	--
$\bar{X}$ =	79.9	75.0	30.2	32.5	42.8	35.6

Ecology and Management of Squirrels

C. M. Nixon

Barkalow and Soots 1965 (Trans. N. Am. Wildl. & Nat. Resour. Conf. 30:349-359) demonstrated a significantly ($P < 0.005$) greater recovery rate for adult gray squirrels exposed to nest boxes compared with those adults

not exposed to nest boxes. Thus far we have been unable to demonstrate any significant improvement in recovery rates of tagged adult fox squirrels that was attributable to nest boxes. For 1976-77, the November-to-March recovery rate for adult males using nest boxes was 85.7 percent (12/14); for adult males not exposed to nest boxes the recovery rate for the same period was 80.0 percent (12/15). Corresponding rates for adult females were 90.0 percent (9/10) and 72.7 percent (8/11).

Adult fox squirrels are dominant over subadults and usurp the better den sites, usually tree cavities. Subadults are forced to use leaf nests or nest boxes (if nest boxes are not considered "choice" nest sites) for shelter. Use of nest boxes may also require a learning process by all age-classes of squirrels. We have found that individual squirrels that are captured in a nest box during the winter are quite likely to be captured in a nest box the next winter. There are some adults of both sexes who reside in areas containing nest boxes but have never been captured in one and may make no use of them.

Fox squirrels seem to know the locations of all leaf nests and tree cavities within their individual ranges and use them when expedient. Particularly in winter, however, squirrels seem to remain in the same nests or dens for extended periods. When released from live traps, squirrels will often run several hundred yards to favored den sites, passing several potential dens.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

A total of 137 prairie chicken cocks were counted on five census areas in four counties of south-central Illinois in the spring of 1977. This total was 12 percent lower than counts made on the same census areas plus two others in 1976.

In contrast to the managed flocks near Bogota in Jasper County, and Farina and Kinmundy in Marion County, which collectively declined 7 percent, the unmanaged flocks near Mt. Erie, Bible Grove, Hoyleton and New Minden declined 53 percent.

Although the Farina and Kinmundy areas are censused separately, they are close enough so that an interchange of prairie chickens between the two areas is likely. Combined, these two areas showed a drop of 5 percent, which is similar to the 7 percent drop at Bogota since the spring of 1976 (MWRL 20(4):3). Viewed separately, between 1976 and 1977 the Farina flock declined from 41 cocks to 30 cocks (-27 percent), but the Kinmundy flock increased from 16 cocks to 24 cocks (+50 percent). The count of 30 male prairie chickens at Farina is about average for the long-term mean starting in 1963, but the count of 24 males at Kinmundy is the highest achieved since the first count in 1964. As in Jasper County, the booming grounds in Marion County were established on or in close proximity to sanctuaries--except in minor instances involving one to three cocks.

Among the unmanaged census areas, two cocks were found on the Mt. Erie (Wayne County) census area--the same number as in the previous spring (1976). The remnant flock near Bible Grove in Clay County apparently disappeared completely, as no prairie chickens were seen or heard booming--two cocks were still present last spring (1976).

The count near Hoyleton in Washington County dropped from 11 males in 1976 to 6 males in 1977. Although six males at Hoyleton is an average count since the first census in 1969, a decline was expected in view of three reports from farmers of nest destruction by hay mowing and plowing in 1976. At nearby New Minden (also Washington County) the count dropped from two males in 1976 to none seen or heard in 1977--although a single hen was observed.

Thus, the unmanaged areas are either defunct or on the verge of extinction. Illinois may soon reach the point where all remaining prairie chickens are dependent on sanctuary grasslands for their continued preservation.

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MONTHLY WILDLIFE RESEARCH LETTER

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Illinois Federal Aid Project W-66-R

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Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

June, 1977

Vol. 20, No. 6

Manipulation of Pheasant Habitat

R. E. Warner

In last month's newsletter (MWRL 20(5):1-2), the rates of predation and success were noted for pheasant nests established in the experimental roadsides in the Sibley Study Area (SSA) from 1963 to 1973. Four years of data (1973-76) subsequently collected from roadside plots on the Ford County Management Unit (FCMU) allow a preliminary comparison of nest success and predation for the roadsides in the two areas. This comparison is merited because seedings on the SSA and FCMU represent two different approaches to roadside management. Approximately 17 miles of seeded roadsides are located in semiscattered fashion over the 36-square-mile SSA. In contrast, nearly all roadsides (73 miles) in or abutting the 16-square-mile (4 x 4) FCMU are managed as nest cover.

Over the period in which roadsides were searched on the two areas, densities of established pheasant nests were similar: 2.15 nests per acre on SSA roadsides, 1963-72, and 2.39 nests per acre on FCMU roadsides, 1973-76. Because the 17 miles of experimental roadside vegetation was only a small fraction of the total prime nest cover on the SSA from 1963 to 1972, only a small proportion of all pheasant nests in the SSA were established on the roadsides. However, it is estimated that over the past 4 years, 33.7 percent of all pheasant nests in the FCMU were established in roadside cover. That one-third of all nests in the FCMU were established on roadsides (representing slightly over 1 percent of the total land area) is a result of the fact that nearly all roadsides are managed and that most other prime nest cover has been removed with the expansion of row crop farming.

Relative to the SSA, roadsides in the FCMU have sustained a greater portion of all nesting activity, and therefore it would seem logical that predator activity would be intensified and nest success reduced on FCMU roadsides as compared with SSA roadsides. However, rates of predation and success of pheasant nests on roadsides do not differ significantly ($P > 0.10$) for the two areas. For the FCMU, 32.3 percent of the nests established on roadside plots from 1973 to 1976 were successful and 47.6 percent were preyed upon (Table 1). For the SSA, 32.5 percent of the nests established on roadsides from 1963 to 1972 were successful and 42.8 percent were preyed upon (MWRL 20(5):2, Table 1). There is no indication that nest predation is increasing from year to year on the FCMU roadside plots (Table 1).

A preliminary comparison of nesting on roadsides in the SSA and FCMU suggests that there is no difference in the rates of nest success and predation for roadsides seeded in a block versus a scattered fashion.

Table 1. Success of pheasant nesting on 68 roadside plots (43.4 acres) on the FCMU, 1973-76.

	1973	1974	1975	1976	$\bar{x}$
Established nests	196	135	54	58	110.8
Nests, hatched	57	54	12	20	35.8
Percent successful	29.1	40.0	22.2	34.5	32.3
Nests, predation	108	46	32	25	52.8
Percent predation	55.1	34.1	59.3	43.1	47.6

Ecology and Management of Squirrels

C. M. Nixon

Breeding rates have not been well documented for the fox squirrel. A search of the literature revealed the following data: (1) Subadults (≤ 10 months old) rarely breed; (2) yearlings (10-14 months old) breed only once during their first breeding year (December-September); (3) adults (15+ months) frequently have two litters during a breeding year.

Since 1971 we have been livetrapping and examining female fox squirrels on two study areas in Vermilion County, Illinois. Many females were captured during both spring and fall breeding periods.

At least on our study areas, females having two litters during a breeding year appear to be the exception rather than the rule (Table 2).

Only in 1971 and 1975 did any appreciable number of females conceive twice. In both years tree seed crops were at least average, and both years followed years (1970 and 1974) when the tree seed crop was above average, particularly for white oak. In addition, breeding was curtailed in 1974 after the general failure of the tree seed crop in 1973. Nearly half (8/17) of the adult females examined in 1974 did not conceive during the breeding year, the highest rate of nonbreeding for the 1971-76 period. Thus, the low breeding rate in 1974 and the excellent tree seed crop that same year may have combined to produce the high number of females conceiving twice in 1975 (Table 2).

Table 2. Number of adult female fox squirrels known to conceive two litters during a single breeding year (December-September).

Year	1971	1972	1973	1974	1975	1976
Number examined	12	10	16	17	14	13
Number breeding twice	4	0	0	1	10	0
Percent breeding twice	33.3	0.0	0.0	05.9	75.7	0.0

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

During the spring of 1977, 53 groups totaling 393 people made reservations and visited the prairie chicken booming grounds in Jasper County. We started the season for visitation by the public on 24 March and terminated the season on 23 April, for a total of 28 mornings.

Students and staff from 14 educational institutions (Fairview High School, Belleville Area College, Wheaton College, Greenville College, Quincy College, College of DuPage, Southeastern Illinois College, Southern Illinois University, University of Illinois, Indiana University, Indiana State University, Earlham College (Indiana), University of Tennessee, and Miami University of Ohio) represented 55 percent of the total number of visitors. Ten Audubon or other ornithological societies supplied 19 percent. Other groups, including women's clubs, scout troops, and personnel of state agencies and museums, made up 9 percent of the total. Various other individuals represented 17 percent.

Illinois supplied 52 percent of the visitors in 1977, Indiana 21 percent, Ohio 12 percent, and lesser numbers came from Tennessee, Missouri, Pennsylvania, Kentucky, and Iowa.

As in previous springs, visitors aided the research project by recording their observations during 66 blind mornings (one booming ground under observation for at least 2 hours by one or more observers in one or more blinds per morning). Hens began visiting the booming grounds on 24 March, with peak numbers noted from 30 March through 12 April. The first of 37 copulations recorded this spring was seen on 30 March; a peak in breeding was evident about 3 April; and a sharp decline in breeding activity occurred after 12 April.

Table 1. Summary of results for the 1971 season. The data are presented in Table 1. The data are presented in Table 1.

Year	1971	1972	1973	1974	1975	1976
Number of birds	11	10	12	11	10	11
Number of eggs	10	10	10	10	10	10
Number of chicks	10.5	10.5	10.5	10.5	10.5	10.5

Summary of results for the 1971 season

Table 1. Summary of results for the 1971 season.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

July, 1977

Vol. 20, No. 7

Manipulation of Pheasant Habitat

R. E. Warner

Spring 1977 breeding populations of pheasants were censused on five areas in a cooperative effort between biologists from the INHS and the DOC. These areas included the Ford County Management Unit (FCMU), the Sibley Study Area (SSA) in Ford County, Anchor Township in McLean County, Harwood Township in Champaign County, and Prairie Green Township in Iroquois County. Audio censusing of cock pheasants was conducted on all areas in May 1977. In addition, visual counts of pheasants were conducted on the SSA and FCMU in late April and May. The SSA and FCMU have traditionally been censused as a part of this project; censusing on the other areas commenced in 1976. Roadsides were seeded in the FCMU in 1968 and in Anchor and Harwood townships in the fall of 1976. Roadsides in Prairie Green will be seeded beginning August 1977.

A great decline in numbers of pheasants was recorded for all areas in May 1977 from populations censused 1 year ago. Visual counts on the SSA and FCMU indicated 30.8 cocks and 22.8 cocks, respectively, per 100 miles of driving in 1977, down 75.0 percent and 80.6 percent from the 123.3 and 117.4 observed per 100 miles in 1976 (Table 1). The audio counts suggested declines of 79.6 percent (SSA) and 67.1 percent (FCMU) over the same period, with similar declines noted for the other three areas (Table 2).

More than one contributing factor can be identified in the decline of pheasant numbers. The most significant factor appears to be the mortality of pheasants during a January 1977 storm. For example, it is estimated that up to 50 percent of the pheasants on the FCMU succumbed to the unusually severe winter weather (MWRL 20(3):1-2). Also of importance, however, was the relatively poor reproduction of the ringneck in 1976. Again using the FCMU as an example, 46 percent fewer broods were observed along standardized routes in 1976 than in 1975; nest data indicate a decline of 13.6 percent in the number of broods hatched.

Hunter harvest in 1976 does not appear to be a major factor leading to the reduced breeding populations censused in May 1977. The winter sex ratio for the SSA and FCMU combined was 17.5 cocks per 100 hens in 1976-77, compared with 28 in 1975-76 and 26 in 1974-75.

Although winter weather is largely responsible for the decline in the abundance of pheasants over the past 12 months, intensive row crop farming is the principle reason for the reduction in numbers that has occurred over the past 15 years.

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Table 1. Number of cocks observed per mile of driving along standardized routes in the SSA and FCMU, April-May 1970-77.

	1970	1971	1972	1973	1974	1975	1976	1977
SSA	0.497	1.669	1.919	2.825	2.308	0.925	1.233	0.308
FCMU	0.974	1.425	0.895	1.285	1.219	0.570	1.174	0.228

Table 2. Number of cock calls per 2-minute stop averaged for the five mornings of highest counts.

	FCMU	SSA ^{a/}	Anchor	Harwood	Prairie Green
1976	22.9	13.7	20.0	11.5	28.4
1977	7.6	2.8	5.7	7.1	9.2
Percent decline	67.1	79.6	71.6	38.3	67.6

^{a/} Counts were made on two mornings in 1976 and four mornings in 1977.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

Adult female fox squirrels usually conceive at least once during a breeding year (December-September). We have examined adult female fox squirrels on two study areas in Vermilion County, Illinois, for the past 6 years. In 1971 (N = 12), 1972 (N = 10), 1975 (N = 14), and 1976 (N = 12), all adult females examined during spring and fall had conceived at least once. In 1973, 3 of 16 adults examined did not breed during the breeding year. In 1974, 8 of 17 did not breed. We feel that the lower breeding rate in 1973 and 1974 was due to the effects of the poor mast crop of 1973. The effects of the reduced tree seed crop were still evident as late as June-July 1974, when summer litters are usually conceived, because those females that did not conceive during the 1973-74 winter period also skipped the 1974 summer breeding period.

At least on our study areas, only about half the available adult females conceived during the winter-spring and summer-fall breeding periods. The average rate of breeding was 56.4 percent (128/227), with a winter-spring rate of 65.5 percent (78/119) and a summer-fall rate of 46.3 percent (50/108). This difference in breeding rates between breeding periods is not significant ($p > 0.05$).

Both study areas are only lightly hunted each fall and the resident squirrels are mostly adults. Squirrels on public hunting areas in Illinois, which experience much higher annual mortality rates than squirrels on our study areas, probably also have higher breeding rates. A comparison of age ratios derived from our livetrapping data with age ratios of squirrels shot on various public hunting areas suggests that breeding rates or juvenile survival rates, or both, are indeed higher on the public areas.

Editors' Note: Mr. Lonnie P. Hansen, a native of Galesburg, joined this project as Assistant Project Leader 1 July 1977. Hansen received the B.S. degree in Zoology at Western Illinois University in June 1971 and the M.S. degree in Zoology from the same institution in August 1973. He has served as research assistant on both the Pheasant Project (summers of 1970 and 1971) and the Squirrel Project (summers of 1974 and 1976). He expects to receive his Ph.D degree from the University of Illinois within the next few months.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Small grains play an important role in the habitat requirements of many species of wildlife in Illinois. In our program of sanctuary management for prairie chickens, wheat or oats follow soybeans as a means of reseeding nest cover and provide booming grounds, brood cover, and night-roosting cover. Generally, not over 10 percent of an individual sanctuary is seeded to small grains. Sharecropping agreements with local farmers are designed to accomplish all tillage, seeding, and harvesting operations, thus keeping biologists "off the tractors." Cash-bid leases are implemented on state-owned sanctuaries. On sanctuaries owned or leased by The Nature Conservancy (TNC), one-third of fertilizer costs and of crop income is accepted by TNC. Revenues generated by limited cropping also help offset management costs and land taxes.

In 1977, the combined effects of low yields, low market prices, and increasing taxes on farmland illustrate the dilemma confronting farmers and landlords alike. Low prices for wheat were the biggest problem, according to local farmers. However, yields of small grains were low because of drought conditions during the growing season. Heavy rains during harvest time presented additional problems. Dockages were severe at grain elevators for such defects as low test weights, damaged kernels, and sprouted wheat. As a result, TNC received \$1,778.50 as one-third of the income from 90 acres of wheat on sanctuaries--an average of \$19.76 per acre. After deductions for one-third of the fertilizer costs (mean of \$11.18 per acre) and of land taxes (mean of \$8.05 per acre in Jasper County), the landlord's (TNC) net income averaged \$0.53 per acre.

1. The first part of the report discusses the general situation of the country and the progress of the work during the year.

2. The second part deals with the results of the various investigations and the conclusions drawn from them.

3. The third part contains the recommendations for the future work and the measures to be taken to improve the situation.

4. The fourth part is a summary of the main points of the report.

5. The fifth part is a list of the references used in the report.

6. The sixth part is a list of the names of the persons who have contributed to the work.

7. The seventh part is a list of the names of the persons who have been consulted during the work.

8. The eighth part is a list of the names of the persons who have been assisted during the work.

9. The ninth part is a list of the names of the persons who have been employed during the work.

10. The tenth part is a list of the names of the persons who have been paid during the work.

Continuance of such dismal agricultural economics portends an uncertain future for wheat. Apparently, a similar situation exists for oats. The results are likely to be (1) a decline in the acreage devoted to small grains on private farmland, (2) more double cropping (soybeans following wheat or oats in the same growing season), and (3) increased acreage of corn and soybeans. We may thus encounter more difficulty in getting sharecroppers to plant small grains on sanctuary land. The shift to less small grains and more row crops will require us to provide more and better brood cover and night-roosting cover on the sanctuaries in the future. The net result will be that more acres of sanctuary will be needed to support a given number of prairie chickens. A sanctuary system that may be adequate today will undoubtedly be too small if small grains disappear from nearby farmland.

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

August, 1977

Vol. 20, No. 8

Manipulation of Pheasant Habitat

R. E. Warner

Roadsides in the Ford County Management Unit (FCMU) seeded in 1968 were considered to be mature as of summer 1970. Each farmer cooperator agreed not to mow these roadsides before 1 August in subsequent years. Since 1970, the chronology of roadside mowing has been monitored to determine the extent of adherence to the delayed mowing agreement. The percentages of the 73 cooperator miles of roadsides unmowed as of 15 July and 1 August 1970-77 are listed in Table 1. The early planting seasons of 1975 and 1976 resulted in a relatively greater extent of early mowing than in previous years because farmers had more than average time available during June and July for early mowing (MWRL 19(8):1-2). The unprecedented extent of early mowing on the FCMU in 1977 (47.5 percent seeded roadsides unmowed, Table 1) is apparently for the same reason. The Illinois Cooperative Crop Reporting Service indicated that the phenology of corn and soybean planting in east-central Illinois for 1977 was even more advanced than in 1976.

For the second year, mature seedings on previously graded roadsides scattered throughout Ford County were monitored for chronology of mowing. In 1976, 20.7 percent of 82 miles of mature seedings (seeded in 1972 and 1974) were unmowed through 1 August. In 1977, 40.9 percent of 137 miles of mature seedings (seeded in 1972, 1974, or 1975) were unmowed as of 1 August. Thus, there was considerably less early mowing on previously graded roadsides in Ford County in 1977 than in 1976. Posting additional explanatory signs abutting graded, seeded roadsides and more widespread publicity on the benefits of roadsides managed for wildlife may in part account for the improved compliance with the delayed mowing agreement.

In 1976, delayed mowing by farmers on the FCMU (64.4 percent unmowed) was substantially greater than on graded, seeded roadsides in Ford County (20.7 percent unmowed). In 1977, however, mowing patterns on the block seeding (FCMU, 47.5 percent unmowed) and scattered seedings (Ford County graded, 40.9 percent unmowed) were similar. Mowing patterns on both types of seedings will be monitored and compared in future years to determine which approach to roadside management will result in the greater compliance by farm cooperators.

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Table 1. Percentage of 73 miles of seeded roadsides on the FCMU unmowed through 15 July and 1 August, 1970-77.

Year	1970	1971	1972	1973	1974	1975	1976	1977
15 July	91.4	86.1	81.2	92.5	87.0	68.1	74.0	61.0
1 August	71.9	81.0	78.4	89.0	87.0	63.0	64.4	47.5

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

Breeding rates for female yearling fox squirrels have not been well documented. The prevailing view seems to indicate that yearlings breed only once during their first breeding year (a breeding year extends from December to September, during which a female fox squirrel may conceive once, twice, or not at all) and have fewer young the first time they conceive, compared with adult breeders.

We have examined yearling females on several study areas since 1972. We found that only about 35 percent (15/42) of these yearlings conceived when 10-14 months old. Of those that did not breed as yearlings, fewer than half bred when 15-18 months old ($9/21 = 42.8$ percent). This breeding rate is much lower than has been reported for female yearling gray squirrels, about 60 percent of which breed at 10-12 months of age.

All females examined were from unhunted forests, where adults comprise about 80 percent of the squirrel population. This high squirrel density, particularly of adult females, may inhibit breeding in yearling squirrels through harassment of the young or by usurpation of the habitats best suited for successful breeding.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

For the first time since 1972, nest success on the sanctuaries at Bogota was above 50 percent this summer. Of the 24 nests found this summer, 3 (12.5 percent) were abandoned, 8 (33.3 percent) were destroyed by predators or farm machinery, and 13 (54.2 percent) were successful. These 13 successful nests produced at least 132 chicks. In 1976, 16 successful nests produced at least 149 chicks.

Other indications of a favorable reproductive season were the absence of nest parasitism by hen pheasants (see MWRL 19(3):3) and the absence of hen kills at the sites of destroyed nests. Also, the number of fertile eggs per clutch increased

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for the second year--from 9.7 in 1975 to 10.9 in 1976 and to 11.3 this year. The number of hatched eggs per clutch increased from 9.6 in 1975 to 10.5 in 1976 and to 10.8 in 1977.

As previously noted (MWRL 18(9):4), it appears that success of the hatch must be about 50 percent to maintain a stable population. On that basis and from the other favorable indications, we expect the population of prairie chickens at Bogota next spring to be very near or above the count of 75 cocks made this past spring.

The second part of the report is devoted to a detailed description of the results of the experiments. It is divided into two main sections: the first section describes the results of the experiments on the effect of the concentration of the solution on the rate of reaction, and the second section describes the results of the experiments on the effect of the temperature on the rate of reaction.

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Urbana, Illinois

September, 1977

Vol. 20, No. 9

Manipulation of Pheasant Habitat

R. E. Warner

Cover maps show that row crop farming has intensified on the Sibley Study Area (SSA) and Ford County Management Unit (FCMU) since the previous growing season. On the SSA, 91.2 percent of the land area was planted to corn and soybeans, compared with 88.3 in 1976, 88.8 in 1975, 89.1 in 1974, 87.1 in 1973, and 65.8 dating back to 1963, when peak numbers of pheasants were observed on the SSA. Hay, pasture, and small grain acreages have diminished proportionately with the expansion of row crop farming; tame hay fields occupied only 0.9 percent of the land area on the SSA in 1977. The FCMU reflects the same trend in land use; hay acreages occupied only 1.0 percent (128 acres) in 1977, down from 1.1 percent in 1976, 1.1 percent in 1975, 1.2 percent in 1974, and 2.2 percent in 1973. Small grains were planted on 1.0 percent (126 acres) of the FCMU in 1977, compared with 2.1 percent in 1976, 2.5 percent in 1975, 3.7 percent in 1974, and 3.6 percent in 1973.

Nest studies on the FCMU indicate an average density of 0.17 hatched nest per acre on seeded roadsides searched in 1977, which is lower than the densities found on roadsides in the previous 4 years (Table 1). Densities in all other types of non-row crop cover on the FCMU were also lower in 1977 than in 1973-76 (Table 1). The estimated number of hatched nests per section in non-row crop cover declined 72.8 percent from 1976. However, among all types of non-row crop cover on the FCMU, roadsides supported the greatest number of nests (Table 2), with an average of 1.3 pheasant nests hatched per section in 1977, a lower average than those of the previous 4 years. On the basis of information in Table 2, roadsides accounted for 53.1 percent of the nests hatched in non-row crop cover in 1977, 47.5 percent in 1976, 26.3 in 1975, 58.8 percent in 1974, and 38.8 percent in 1973, with a 5-year mean of 46.1 percent. Seven of the 17 (41.2 percent) nests established on the 68 roadside plots searched in 1977 were successful.

For the second year, nest searches have been conducted on a sample of 90 0.25-mile plots that were selected from the Ford County Graded Roadsides (FCGR). These roadsides are scattered throughout 9 different townships and were seeded by the DOC in 1972, 1974, or 1975, after the roadsides had been graded by the township road commissioners. In 1976 no pheasant nests were found on the 9.9 acres of seedings (1975) that were searched--presumably because the vegetation was not well established. The 52.4 acres of mature (seeded in 1972 and 1974) roadside cover searched in 1976 had 0.44 established and 0.17 hatched pheasant nest per acre. In 1977, nesting occurred on the roadsides seeded in 1975 as well as on earlier seedings. The limited number of pheasant nests found on the FCGR in 1977 prevented testing for differences

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in nest establishment among the ages of roadside vegetation. Averages of 0.24 established and 0.12 hatched nest per acre were determined for the 57.7 acres of roadside searched in 1977. Seven of the 14 (50 percent) nests established on the FCGR plots were successful. The decrease in nesting on the FCMU and FCGR in 1977 compared with 1976 is a result of the sharp decline in the population of breeding hens recorded in May 1977 (MWRL 20(7):1-2).

The numbers of broods observed along transect routes on the FCMU, SSA, and the three townships where roadside seedings have recently been made also reflect the sparse populations censused on these areas in spring 1977 (MWRL 20(7):1-2). On the basis of the August 1977 census of broods (Table 3), there have been reductions of 70.0, 6.7, and 70.6 percent, respectively, from 1976, in the numbers of broods observed per 100 miles of driving in the townships of Prairie Green (Iroquois County), Harwood (Champaign County), and Anchor (McLean County). On the SSA there were 2.3 broods observed per 100 miles of driving in August 1977, down from 10.3 in 1976, 30.1 in 1976, 17.1 in 1974, and 35.0 in 1973. On the FCMU, 26.9 broods per 100 miles were counted in August 1977, an 8.5 percent reduction from the preceding year (Table 3). The actual decline in numbers of pheasants on the FCMU, comparing August 1977 with August 1976, is probably greater than the 8.5 percent decline in the brood census and less than the 72.8 percent decline in the numbers of hatched nests recorded in non-row crop cover. Implications of the findings from the 1977 breeding season will be discussed in next month's newsletter.

Table 1. Pheasant nests hatched per acre in non-row crop cover on the FCMU, 1973-77.

Cover	1973	1974	1975	1976	1977
Roadsides	1.30	1.23	0.27	0.48	0.17
Strip & nonagricultural	0.24	0.14	0.17	0.06	0.03
Hay	0.48	0.33	0.02	0.10	0.02
Pasture	0.34	0+	0+	0+	0+
Small grains	0.08	0.03	0.06	0.09	0+

Table 2. Pheasant nests hatched per section in non-row crop cover on the FCMU, 1973-77^a.

Cover	1973	1974	1975	1976	1977
Roadsides	10.3	9.7	2.1	3.8	1.3
Strip & nonagricultural	7.4	4.2	4.6	1.6	0.7
Hay	5.5	2.0	0.2	1.0	0.2

The first part of the report is devoted to a description of the experimental apparatus and the method of measurement. The second part contains the results of the measurements and a discussion of the results. The third part contains the conclusions and the references.

The experimental apparatus consists of a gas cell, a light source, a monochromator, a photomultiplier, and a recording device. The gas cell is a cylindrical vessel of stainless steel, 10 cm in diameter and 20 cm in length. It is filled with the gas to be studied. The light source is a tungsten lamp, which is filtered by a series of glass filters to produce a continuous spectrum. The monochromator is a grating monochromator, which is used to select a narrow band of wavelengths. The photomultiplier is a vacuum tube, which is used to detect the light. The recording device is a pen recorder, which is used to record the signal from the photomultiplier. The method of measurement is as follows: The gas cell is filled with the gas to be studied. The light source is turned on, and the monochromator is set to a particular wavelength. The photomultiplier is connected to the recording device. The signal from the photomultiplier is recorded as a function of time. The results of the measurements are shown in the following table.

The results of the measurements are shown in the following table.

Wavelength (nm)	Intensity (a.u.)	Wavelength (nm)	Intensity (a.u.)
400	1.0	600	1.0
450	1.5	650	1.0
500	2.0	700	1.0
550	2.5	750	1.0
600	3.0	800	1.0
650	3.5	850	1.0
700	4.0	900	1.0
750	4.5		
800	5.0		
850	5.5		
900	6.0		

The results of the measurements are shown in the following table.

Wavelength (nm)	Intensity (a.u.)	Wavelength (nm)	Intensity (a.u.)
400	1.0	600	1.0
450	1.5	650	1.0
500	2.0	700	1.0
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600	3.0	800	1.0
650	3.5	850	1.0
700	4.0	900	1.0
750	4.5		
800	5.0		
850	5.5		
900	6.0		

Pasture	1.7	0+	0+	0+	0+
Small grains	1.5	0.6	1.1	1.7	0+
Total	26.3	16.5	8.0	8.1	2.2

^a Estimated for a 20-square-mile area: the 16-square-mile (4 x 4) block and the 0.25 perimeter.

Table 3. Number of broods observed per 100 miles of driving along standardized routes during August, 1975-77.

Area	Broods Observed per 100 Miles		
	1975	1976	1977
FCMU	54.4	29.4	26.9
SSA	30.1	10.3	2.3
Anchor ^a	--	17.7	5.2
Harwood ^a	--	7.5	7.0
Prairie Green ^b	--	19.0	5.7

^a Roadsides seeded in fall 1976.

^b Roadsides seeded in fall 1977.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

The effects of breeding, pregnancy, and nursing young must, at times, place severe stress on the female fox squirrel, particularly in early spring after a food-short winter.

How much more food does a breeding female require compared with a non-breeding female? To answer this question, we measured the daily food intake of two penned females with three and four nestlings, respectively, and compared this food intake with that of two nonbreeding adult females. The four adults were individually housed in pens (2 m x 1 m x 2 m) equipped with nest boxes, automatic feeders, and water dishes.

As shown in Table 4, the food intake and the amount of energy digested were similar for the four females on 13 March, approximately 2 weeks after birth of the seven young. On 3 April, 4 weeks postpartum, the females nursing young required an average of 77 percent (29.9 g) more food than the non-breeding squirrels and 66.1 percent (99.5 kcal) more digested energy. By 27 April, when the young were first seen, the mothers were consuming an average of 91.9 g/day, or 51.4 g (143.4 percent) more than the average for

the control animals. This difference in food intake resulted in an additional 199.7 kcal/day (148.6 percent) in digested energy for the mother squirrels. By 14 May, the approximate weaning age of the young, the mothers and young squirrels had an average food intake of 131.2 g/day and an average of 507.5 kcal/day of digested energy. These values represent a 226.4 percent increase in food intake and a 235.8 percent increase in digested energy over those of the nonbreeding squirrels (Table 4).

Thus, breeding females must have available a supply of energy-rich food, particularly during the last half of the nursing period. It is fortunate that in Illinois this period corresponds to the breaking of winter dormancy for trees and shrubs. The new shoots, flowers, and seeds are full of nutrients and provide the mother squirrels with a rich and varied diet.

Females usually do not breed in winters that follow failures of tree seed crops probably because they have been unable to build up sufficient body fat reserves to sustain pregnancy.

Table 4. Mean food consumption (g) and digested energy (kcal) per day for two fox squirrels nursing young, two nonbreeding adult females, and the same two mother squirrels 1 year later.

Date	Mother, 3 Young		Mother, 4 Young		Mean of 2 Non-breeding Females		Mean of Mothers 1 Year Later	
	g/day	kcal digested/day	g/day	kcal digested/day	g/day	kcal digested/day	g/day	kcal digested/day
13 March ($\approx$ 2 weeks after birth of young)	55.0	196.9	64.5	225.9	63.3	232.3	31.8	118.7
3 April	75.2	276.1	61.9	223.7	38.7	150.4	30.9	114.7
13 April	89.7	335.4	83.1	306.1	45.4	165.6	22.8	87.2
19 April	82.3	281.7	81.4	274.8	43.7	166.2	--	--
27 April	93.1	343.6	90.6	324.5	37.7	134.4	40.5	162.6
5 May	99.3	379.9	111.7	430.6	34.1	126.1	--	--
14 May ($\approx$ weaning age)	128.3	487.4	134.1	527.5	40.2	151.1	42.9	173.0

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

As reported in the preceding newsletter (MWRL 20(8):2-3), nest success for prairie chickens at Bogota in 1977 showed an encouraging improvement (59.1 percent hatched) over the preceding 4-year period. Nesting by two of

Illinois' major upland game birds, quail and pheasants, raises the question about the comparative numbers and success of these two species on the prairie chicken sanctuaries (Table 5). In 1977, nest success was high for bobwhite quail on the sanctuaries--77.8 percent of 18 nests were hatched. However, none of the four pheasant nests found on the sanctuaries in 1977 was successful (which is fortunate in this case--see MWRL 19(12):3-4).

Of particular concern is the period of 1973-76, when nest success for prairie chickens was the lowest (31.1 percent successful) on record, due to predation. It is not surprising that nest success for quail was correspondingly low during the same 4-year period (22.2 to 35.7 percent successful). Success of pheasant nests, however, was relatively high (except for 1974) during the period of 1973-76. Overall, nest success for both quail and pheasants on the sanctuaries is relatively high compared with success rates reported in the literature and with unpublished data on pheasants by R. E. Warner (MWRL 20(5):2 and 20(6):2).

The most curious and worrisome aspect of the nest search on the sanctuaries in Jasper County in 1977 is the relatively low number of prairie chicken nests found. The acreage searched (about 400) was similar to that searched in previous years. The population level was not greatly dissimilar (81 cocks in 1976, 75 cocks in 1977) and the numbers of hens and copulations observed on booming grounds in 1976 and 1977 were essentially the same. Yet, our sample of 24 prairie chicken nests in 1977 is not quite half of the sample found in 1976.

Despite the limited sample of prairie chicken nests in 1977, nest success at Bogota would most likely have been much higher except for a family of mink found on the Yeatter Sanctuary. A den in the central portion of this tract, occupied by skunk in 1976, was reoccupied by mink in 1977. In June 1977, mink likely caused the destruction of (1) six of nine prairie chicken nests, (2) all of three pheasant nests (plus two hen kills), and (3) one of two quail nests (plus one hen kill) on the Yeatter Sanctuary. Trapping at the den site resulted in the capture of three mink. A fourth mink carcass was found about 250 yards from the den, and a fifth mink was killed by the nest crew on the nearby Field Sanctuary. The presence of mink was surprising because of (1) the prairie environment, and because (2) nest predators on sanctuaries are typically considered to be opossum, skunk, and raccoon.

Table 5. Comparative numbers and success^a of prairie chicken, quail, and pheasant nests on sanctuaries on the Bogota Study Area, 1963-77.

Year	Prairie Chicken		Bobwhite Quail		Ring-necked Pheasant	
	Number of Nests	Percent Successful	Number of Nests	Percent Successful	Number of Nests	Percent Successful
1963	9	100.0	5	80.0	0	
1964	17	58.8	4	50.0	0	
1965	4	66.7	0		0	

1966	5	100.0	2	100.0	0	
1967	10	50.0	14	75.0	0	
1968	18	72.2	21	57.9	0	
1969	28	64.3	58	43.2	1	?
1970	63	66.1	33	46.4	7	50.0
1971	62	66.7	40	42.9	10	55.6
1972	86	64.9	33	80.0	4	100.0
1973	84	31.1	16	35.7	9	44.4
1974	65	41.7	9	22.2	4	25.0
1975	59	42.1	20	35.7	6	66.7
1976	46	35.6	28	32.1	5	40.0
1977	24	59.1	18	77.8	4	0.0
Total or Mean	542	53.5	301	50.2	50	42.0

^a Nests of unknown fate and empty nests were excluded in calculating nest success.

MONTHLY WILDLIFE RESEARCH LETTER

NATURAL HISTORY SURVEY

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Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

October, 1977

Vol. 20, No. 10

Manipulation of Pheasant Habitat

R. E. Warner

Expansion of row crop farming, particularly since the early 1960's, has been at the expense of suitable nest and brood-rearing habitat for the ring-neck in the east-central counties of Illinois. In recent years, corn and soybeans have been planted over approximately nine-tenths of the land area of the Sibley Study Area (SSA) and the Ford County Management Unit (FCMU), as reported in the September research letter. By May 1977, the gradual loss of essential habitat in conjunction with an unusually severe winter storm had reduced populations of pheasants on these two study areas to the lowest number noted in recent decades. However, moderate increases in numbers of pheasants are expected on the study areas over the next few years as the ringneck approaches prestorm densities. This expectation is based on the assumption that the present intensity of row crop production will remain constant for the near future and that normal weather patterns will prevail. The rate of replenishment to prestorm numbers is uncertain, but findings from the reproductive season of 1977 show some sign of recovery.

Nest success on the FCMU and Ford County Graded Roadsides (FCGR) was unusually high in 1977, 41.2 and 50.0 percent, respectively (MWRL 20(9):1-2). Typically, one-third of the nests established by pheasants on roadsides are hatched. Hence, the decline in numbers of breeding hens for 1977 was in part compensated by the greater-than-average nest success. There was no evidence, however, of a departure from the average clutch size or from trends in brood survival as recorded for the SSA and FCMU over the past 15 years.

Findings from recent censuses on the FCMU and SSA suggest that when the numbers of pheasants are low, the block roadside seeding (FCMU) maintains and perhaps increases the margin of pheasant abundance over the unmanaged (SSA) area. In December 1973 an aerial count of pheasants on these study areas indicated that nearly twice the number of pheasants counted per section on the SSA were visible on the FCMU. In early January 1977 (prior to the severe storm) populations on the two study areas were substantially lower than in 1973, and over three times the number of pheasants counted per section on the SSA were visible on the FCMU (MWRL 20(2):2, Table 1). The number of broods observed along transect routes on the two study areas in 1977 (MWRL 29(9):2) appear to confirm that as populations have diminished, the difference in pheasant abundance between the SSA and FCMU has increased.

Hunter success on the SSA and FCMU during the opening weekend of this year's pheasant season is fairly predictable. If weather continues favorable, the corn and soybean harvest will approach completion and fall plowing will be well advanced by early November. A similar chronology of crop harvest and plowing was noted for 1976 and 1975. Therefore, the influence of harvest activities on the availability of pheasants to the hunter in 1977 is expected to be similar to that of the past two seasons. Thus, hunter success this year will be primarily affected by the abundance of pheasants. With sparse numbers of pheasants present on the SSA and FCMU this fall in comparison with previous years, the man-hours expended by hunters on the study areas to bag a cock during opening weekend will probably approach a record high in 1977.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

Which of the staple foods of fox squirrels in Illinois provides them with the best balanced diet?

To answer this and other questions regarding fox squirrel nutrition, we compared the daily food consumption, digestion and assimilation coefficients, metabolized energy, and balances of six selected elements [sodium (Na), potassium (K), calcium (Ca), magnesium (Mg), phosphorus (P), and nitrogen (N)] among diets of four species of oak (white, red, black, and bur), two species of hickory (mockernut and shagbark), black walnuts, corn, and soybeans fed to adult female fox squirrels under simulated winter temperatures and photoperiods. We used only adult females in order to minimize the variability in the results (eliminate sex and age differences) and because we believe the well-being of the adult female is essential to the continued prosperity of the overall squirrel population.

Shagbark hickory (7,561 cal/g) and mockernut hickory (7,386 cal/g) had the highest caloric values of the diets examined, followed by black walnuts (7,036 cal/g). Soybeans (5,488 cal/g) had a slightly higher caloric content than black oak (5,360 cal/g), bur oak (5,052 cal/g), and red oak (4,919 cal/g). White oak (4,461 cal/g) had the lowest caloric value of the diets examined, being almost identical with corn embryos (4,480 cal/g). Shagbark hickory contained 69 percent (3,100 cal/g) more energy than white oak.

The average percentage of foods digested ranged from a low of 86.55 percent for corn germ to a high of 95.92 percent for black walnut. The percentage of corn germ digested was significantly ($P < 0.05$) lower than digestion rates for the other foods. The coefficients of digestion for shagbark hickory, mockernut hickory, and black walnut were significantly higher than all other coefficients of digestion except that of red oak.

The coefficients of assimilation (digested energy minus calories of urine) showed a similar trend, with corn (83.65 percent) and soybeans (82.37 percent) having lower coefficients than the other foods. The oaks had similar intermediate coefficients of assimilation (≈ 86.00 percent) that fell between the lower values of the grains and the higher values of walnuts (87.23 percent), shagbark (92.31 percent), and mockernut hickory (94.61 percent). The coefficients of assimilation for mockernut and shagbark hickory were significantly higher than the coefficients of the other foods.

The amount of energy metabolized per day by the fox squirrels on the various diets also varied significantly. Metabolic body weight of the squirrels was expressed as kilograms body weight raised to the 0.5 power. The kcal/day $\text{wt}_{\text{kg}}^{0.5}$ metabolized ranged from a low of 85.72 for red oak to a high of 148.83 for white oak. Red oak was the only mast food with a lower amount of metabolized energy per day than corn germ (99.94 kcal/day $\text{wt}_{\text{kg}}^{0.5}$) and soybeans (102.11 kcal/day $\text{wt}_{\text{kg}}^{0.5}$). With the exception of red oak, there were no significant differences in the energy metabolized per day among the other mast foods. Red oak and corn germ were significantly lower in metabolized energy than all of the other diets examined except soybeans.

The average weight change per day of the squirrels on the various diets somewhat parallels the amount of energy metabolized on each diet. White oak, which had the highest amount of energy metabolized, also caused the largest average change in female weight (+9.5 g). Squirrels fed mockernut hickory had the second largest average increase in weight (4.1 g). Squirrels fed red oak and corn germ diets had the lowest metabolized energy and were the only groups to have an average weight loss during the feeding trials (-0.6 g and -2.9 g, respectively).

Sodium had the lowest percentage concentration of the macronutrients investigated in the foods, and nitrogen generally had the highest percentage. As a group, the oaks had average concentrations of Na, K, and Ca, but, in relation to the other foods, they had the lowest concentrations of Mg, P, and N. Of the four species of oaks examined, black oak had the highest concentration of nutrients, with the exception of K. Shagbark and mockernut hickories were average in concentrations in most of the nutrients but were lowest in the concentration of K and had higher concentrations than oaks of all the other nutrients. Walnuts had one of the highest concentrations of Na among the nine foods considered and had high concentrations of Mg, P, and N, and low amounts of K. Corn embryos were low in Na and Ca, contained average amounts of K and N, and had the highest concentrations of Mg and P in relation to the other foods. Soybeans not only had the highest concentrations of K, Ca, and N among the diets but also had high concentrations of the other nutrients. The balances of Na and Ca were negative for all of the diets examined. The balances of K, Mg, P, and N were generally positive. Corn germ was the only diet that had a negative balance for every macronutrient examined.

More grams of white and bur oaks and fewer grams of the hickories were consumed per day among the diets tested. Significantly more grams of white oak/100 g of body weight/day were eaten than any of the other diets. Significantly more bur oak was eaten than soybeans, and consumption of both bur and black oak was significantly greater than consumption of walnuts, red oak, and the hickories.

We will examine the significance of these findings in relation to the management of fox squirrels in Illinois in subsequent monthly reports.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Currently we are summarizing and compiling this project's 15-year accumulation of data on prairie chicken nest ecology. We are planning comprehensive computer analyses of our data, primarily covering the years since

1966. This time span (12 years) will provide a sample of well over 500 prairie chicken nests with associated variables.

As now visualized, the analyses will include stepwise multiple correlation analysis, with annual abundance of prairie chickens (as determined by counts on booming grounds in spring) as the dependent variable. Independent variables are in four categories--nest data, habitat, interspecies relations, and weather. This analysis should determine those variables affecting annual prairie chicken abundance and help us to predict spring populations of chickens.

We also plan to utilize discriminant function analysis for data relating to individual nests and fields to determine those factors affecting nest success and nest density. These analyses will deal with habitat and with intraspecies and interspecies relations. We hope to be able to define optimum nest cover from the standpoint of nest success (predator-resistant cover) and nest density. These and other analyses should enable us to produce a definitive description of the nest ecology of prairie chickens in Illinois.

The major problem in achieving this goal is the sheer volume of data. We can easily exceed the capabilities of current computer programs. For example, the stepwise multiple correlation program is limited to 199 independent variables. A preliminary list of independent variables for our study already contains 180 variables. The discriminant function analysis program is limited to 70 variables. We have at least triple that number of variables available for analysis. Therefore, in addition to compiling these data in a form suitable for computer analysis, we must carefully scrutinize all variables and select those we feel are important for a particular analysis.

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Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

November, 1977

Vol. 20, No. 11

Manipulation of Pheasant Habitat

R. E. Warner

Relatively few pheasant hunters were observed on the Sibley Study Area (SSA) and Ford County Management Unit (FCMU) during the 12-13 November opening weekend of the 1977 upland game season. This scarcity of hunters and the low level of success experienced by the hunters that journeyed afield on the opening weekend are further evidence of the decline in numbers of pheasants that has occurred over the past year, as documented by spring and summer censusing (MWRL 20(9):1-3). Nineteen hunters interviewed during the opening weekend on the SSA expended 105 hours to harvest three pheasants (35 hours per bird). The hours of hunting required to kill a cock pheasant on the SSA opening weekend in 1962 through 1976 were 2.2, 2.7, 2.1, 8.0, 6.9, 8.1, 5.0, 4.3, 4.7, 3.4, 6.2, 7.4, 8.3, 16.5, and 9.7, respectively. On the FCMU, the 60 hunters that were interviewed during opening weekend 1977 expended 277 hours to harvest 24 pheasants (11.6 hours per bird). The hours of hunting required to kill a cock pheasant on the FCMU opening weekend in 1974 through 1976 were 3.1, 4.7, and 6.0, respectively.

The time expended for each cock harvested on the SSA in 1977 was three times as great as that expended per bird on the FCMU; compared with the SSA, about three times as many hunters were observed on the FCMU. The difference in hunter pressure on the two study areas appears to reflect the difference in the abundance of pheasants.

Although hunter success on the study areas is primarily related to pheasant abundance, the progression of crop harvest and fall plowing is also influential. This year, as in 1975 and 1976, fall farming activities were expected to be well advanced. In 1976, the harvest and fall plowing on the study areas approached completion by the second weekend of November; a similar trend was developing this fall until heavy rainfall delayed field work in late October and early November. By 12 November 1977 less than one-third of the farmland on the study areas was plowed, and unharvested crops remained on approximately one-fifth of the row crop acreages. The fields of standing crops (principally corn) provided ample cover for the ringneck to evade hunters. Therefore, the poor hunter success on the study areas this fall is the result of a decline in the abundance of pheasants, aggravated by standing crops that minimized the availability of the pheasant resource to hunters.

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Journal of Interpersonal Violence 26(10) 1978-1994

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Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

In the last research letter (20(9):3) we pointed out that adult female fox squirrels fed under simulated winter temperatures and photoperiods gained the most weight per day on white oak acorns (9.5 g/day). They also gained weight on mockernut hickory nuts (4.1 g/day), shagbark hickory nuts (3.5 g/day), soybeans (2.6 g/day), black oak acorns (2.1 g/day), and black walnuts (2.0 g/day). They lost weight on red oak acorns (0.6 g/day) and corn (2.9 g/day). On the respective diets, these females ate about 10 white oak acorns per day, 10 hickory nuts per day, and 20 black oak acorns per day.

In terms of tree abundance, white and black oaks and the hickories are the most common squirrel food species in Illinois. As of 1962 (the last forest survey in Illinois) there were, on the average, nine white oaks, eight black oaks, and five hickories larger than 9.0 inches dbh per acre in upland forest types in Illinois. This number of white oak trees would produce about 46 pounds of sound seed per acre per year, enough to feed one fox squirrel for about 550 days. Of course, many other species eat acorns and probably consume more of the annual tree seed crop than do fox squirrels. How much of the annual crop is eaten by squirrels is unknown, but, considering the abundance of such acorn eaters as flying squirrels, deer mice, and chipmunks, we doubt that fox squirrels eat half the annual seed crop.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

A basic objective of habitat management for most wildlife is to achieve uniformly good habitat and thereby obtain a uniformly good distribution and abundance of wildlife on the acreage available for management. Concentrating most of an animal population on a small proportion of a management area is to be avoided if possible. Total numbers are important, but a better measure of a successful wildlife manager is the attainment of both (1) high densities and (2) populations distributed as uniformly as possible over given acreages. Use of this concept is becoming more appropriate for evaluating the management program for prairie chickens at Bogota because the sanctuary acreage has stabilized at 1,001 acres since 1973. The number of cocks on booming grounds on or within 0.5 mile of the seven sanctuary units scattered over 8 contiguous square miles provides the basis for this evaluation.

The Yeatter-Field-McGraw unit, which composes 23 percent of the sanctuary acreage, lies in both (1) the traditional central core of the prairie chicken population and (2) the approximate center of the sanctuary system at Bogota. Between 1963 and 1972, this 232-acre unit supported 54 to 75 percent of the cock population and 37 to 79 percent of the observed hen population in the flock at Bogota. Since 1973, however, the Yeatter-Field-McGraw unit has maintained 45 to 56 percent of the cock population and 30 to 45 percent of the observed hen population. Thus, while this unit still contains a prairie

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chicken population disproportionate to the total sanctuary acreage, we have noted some tendency of the Bogota flock to disperse to other units over the past 5 years.

The Donnelley-Walters unit, located in the section adjacent to the Yeatter-Field-McGraw unit, had no booming grounds when the first parcel (60 acres) was acquired in 1964. Since 1973, the 160-acre Donnelley-Walters unit comprised 16 percent of the sanctuary acreage and supported 19 to 32 percent of the cock population and 21 to 35 percent of the observed hen population. Thus, the Yeatter-Field-McGraw and Donnelley-Walters units, totaling 392 acres and comprising 39 percent of the sanctuary acreage, have contained 64 to 88 percent of the cock population and 51 to 80 percent of the observed hen population during the breeding seasons of the past 5 years.

It is hoped that a better distribution of the Bogota flock can be achieved with continued improvements in the habitat on the peripheral sanctuary units. However, numerous factors may preclude the attainment of a breeding population dispersed strictly in proportion to the available acreage of sanctuaries. Factors currently limiting the attractiveness of the peripheral units to prairie chickens include (1) proximity to woodland, human activity, and domestic pets (Otis-Fuson unit), (2) woodland and distance from other units (J. McCormack unit), (3) free-ranging dogs and the hemming-in effect of mature woody fencerows (C. McCormick unit), (4) rough topography and brush (Galbreath unit), and (5) disturbance by humans, pets, and pheasants, and perhaps insufficient size (Mark unit, 57 acres).

There may also be behavioral aspects in the Bogota flock that will continue to limit the extent to which the breeding population will establish outside of the central units. Recent studies, in other states, of nesting hens monitored by radiotelemetry have shown that hens commonly nest closer to distant booming grounds than to the booming grounds on which they were mated. Also, distances of 1-2 miles between booming grounds and nests are not uncommon. Thus, the peripheral units may be more important to the maintenance of the Bogota flock than the numbers of cocks and hens on booming grounds in the central units appear to indicate.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

December, 1977

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Manipulation of Pheasant Habitat

R. E. Warner

There are about 2,500 acres of potential nest habitat adjacent to four-lane (interstate) highways in east-central Illinois. Although comprising only about 5 percent of the roadside acreages in the east-central counties, interstate roadsides offer substantial management potential for pheasants and songbirds. Preliminary evaluations of nesting on roadsides of four-lane highways were conducted as a part of this project in 1971 and 1972 along I-57 and I-74 in Champaign County. Densities of pheasant nests on the eight plots (totaling 17.7 acres) indicated that nesting activity on the fescue interstate roadsides was low relative to nesting in nearby hayfields and to nesting on managed brome-alfalfa vegetation along secondary roads in the Sibley Study Area. Thus, in view of studies made of brome-alfalfa, the benefits of fescue seedings as nest habitat along interstate highways seemed questionable.

In order to make a controlled evaluation of the potential of brome-alfalfa and fescue seedings for nesting along interstates, in 1973 the Illinois Department of Transportation seeded to brome-alfalfa approximately 1 mile of roadsides along the newly constructed FAI-55 near Odell; a 1.2-mile stretch of fescue was seeded on the roadsides abutting and directly north of the brome-alfalfa seedings. The test seedings were expected to become established within 2 or 3 years, and in 1976 a nest study was initiated. That year, sweet clover dominated the roadsides near Odell, and although searches in mid-June revealed four pheasant nests on five 0.125-mile plots totaling 4.6 acres (0.87 established and 0.22 hatched nests per acre), the vegetation along the 2.2-mile stretch was not representative of the prescribed seeding types. Eight songbird nests (1.74 per acre) were found in the sweet clover.

In 1977 the future of the Odell seedings as an evaluation site appeared more promising. Brome and alfalfa (particularly alfalfa) were dominant species along the southernmost mile of the 1973 seeding; a mixture of bluegrass, fescue, clover, and redtop (in respective order of dominance) was established along the abutting 1.2 mile. Mid-June and mid-July searches for nests were conducted in 1977 on four brome-alfalfa and six fescue plots, totaling 6.0 acres. For each type of seeding, an equal number of plots (two brome-alfalfa and three fescue) were searched along northbound and southbound lanes. The northbound lane was not used in 1976 or 1977 except for construction vehicles. Traffic along the southbound lane was similarly restricted in 1976 but became heavy in 1977, when southbound vehicles from old I-55 were rerouted to this lane. Neither of the

THE UNIVERSITY OF CHICAGO

DEPARTMENT OF CHEMISTRY

RESEARCH REPORT

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seeding types exhibited an overall difference in appearance of composition according to their adjacency to northbound or southbound lanes. The searches in 1977 failed to locate any pheasant nests on the plots, presumably because of the sparse breeding population documented for Livingston County by Department of Conservation biologists. Fifteen red-winged blackbird nests (6.6 per acre) were found on brome-alfalfa plots and two (0.5 per acre) on fescue plots. Two rabbit nests and a pair of adult meadowlarks and two fledglings were also noted on fescue plots. Thirteen of the 17 blackbird nests were found adjacent to the northbound lane, used only for construction vehicles. Thus, the selection of nest habitat by redwings in this area may have been influenced by traffic patterns.

To date, the FAI-55 roadsides near Odell have not been representative of the prescribed brome-alfalfa and fescue vegetation. However, the plots now show signs of becoming well-established seedings; which will allow a more meaningful study at Odell in future years.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

Female fox squirrels fed under simulated winter conditions ate more, metabolized more energy, and gained more weight on white oak acorns than on any other diet examined. However, evaluating food preferences of squirrels on the amount of a particular diet they eat may be misleading. More of one specific diet than another may be needed to attain the requisite levels of nutrition for good health.

The high level of consumption of white oak acorns and the large weight gain (9.5 g/day) experienced by female fox squirrels in our study are noteworthy in that white oak acorns germinate soon after falling to the ground in the fall. The period of mid-to-late fall is the time when fox squirrels are eating more food and rapidly gaining weight. Proper nutrition at that time is apparently the key to increased survival and successful late-winter reproduction for female fox squirrels.

Studies of squirrel food habits have shown white oaks to be preferred over other oaks; red oak acorns have been the least preferred. The preference of squirrels for white oak acorns is thought to be caused by the higher tannin content of red and black oak acorns.

It is fortunate for Illinois fox squirrels that white oak is the most common tree in the upland forests. In years when the white oak seed crop is heavy, fox squirrels can survive and reproduce normally regardless of the severity of the winter. This fact was well demonstrated during the severe winter of 1976-77, which followed an excellent white oak seed year. In central Illinois, the winter-spring breeding rate for female fox squirrels was the highest in the past 7 years.

The reverse also occurs. In 1973, when the white oak seed crop failed and other tree seed crops were below normal, the winter-spring breeding rates of

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1. The first of these is the fact that the majority of the population of the United States is now living in urban areas. This is a result of the process of urbanization, which has been going on since the beginning of the 20th century. The process of urbanization is the movement of people from rural areas to urban areas. This movement is caused by a number of factors, including the search for better living conditions, the desire for education, and the need for employment. The process of urbanization has led to the growth of large cities and the decline of small towns. This has had a number of effects on the United States, including the concentration of population in a few areas, the loss of rural life, and the development of a new urban culture.

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1. The Government of the United States of America, hereinafter referred to as the "Government,"

has called upon the people of the world to fight against the forces of imperialism and to establish a new world order based on justice and equality.

squirrels in 1974 were also well below normal in central Illinois and so was the squirrel harvest the next fall.

Although fox squirrels have demonstrated food preferences, they eat the most abundant species, or, in poor tree seed years, whatever species are available. This finding points up the importance to squirrels of maintaining a mixed species composition of forest stands. In most years, a mixture of oaks, black walnut, and hickories insures an adequate supply of food throughout the winter.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

As noted in MWRL 20(10), we are compiling our data on prairie chicken nest ecology and examining all variables for suitability for inclusion in computer analyses. All data relating to annual nesting effort, nest success, mammal populations, and nest densities of other avian species have been summarized. Simple linear correlation coefficients were calculated for each variable with annual abundance of prairie chicken cocks on booming grounds the next spring. Many correlation coefficients relating nesting effort and nest success to subsequent populations were significant. Those variables significantly and positively correlated with annual abundance of male prairie chickens included total number of nests found ($r = 0.791$), nest density ($r = 0.631$), number of chicks hatched ($r = 0.899$), hatchability of eggs ($r = 0.660$), and the maximum number of hens seen on booming grounds ($r = 0.822$). Clutch size and fertility of eggs were not significantly correlated with annual abundance.

Correlation coefficients were also calculated relating indices of mammal populations and nest densities of other birds with prairie chicken nest success. For the mammal data, density of Microtus and Synaptomys nests ($r = 0.614$), number of rabbit nests ($r = 0.702$), and number of live rabbits seen during nest searches ($r = 0.627$) were positively correlated with prairie chicken nest success.

None of the variables concerning nest densities of other avian species was significantly correlated with prairie chicken nest success. However, the ratio of the number of prairie chicken nests to the total number of nests of other ground-nesting species was significantly and negatively correlated ($r = 0.692$) with nest success. In other words, as the proportion of prairie chicken nests to nests of other ground-nesters increased, nest success of prairie chickens declined. This phenomenon was alluded to in MWRL 17(2):2.

These preliminary evaluations of certain variables are not definitive but they indicate which variables may be important in the total analysis. We intend to scrutinize habitat and weather variables in a similar fashion when they are finally summarized.

1. The first part of the report deals with the general situation of the country and the progress of the work during the year.

2. The second part of the report deals with the results of the work done during the year. It is divided into two main sections: (a) the results of the work done in the field, and (b) the results of the work done in the laboratory.

3. The third part of the report deals with the conclusions drawn from the results of the work. It is divided into two main sections: (a) the conclusions drawn from the field work, and (b) the conclusions drawn from the laboratory work.

4. The fourth part of the report deals with the recommendations made by the committee. It is divided into two main sections: (a) the recommendations made by the field committee, and (b) the recommendations made by the laboratory committee.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

January, 1978

Vol. 21, No. 1

Manipulation of Pheasant Habitat

R. E. Warner

For the second consecutive year seeded roadside plots on the Ford County Management Unit (FCMU) and Ford County Graded Roadsides (FCGR) were searched for nests of both pheasants and songbirds. All roadside plots were searched once in mid-June and again in mid-July. The June and July searches indicated a total of 55 songbird nests on the 67 FCMU plots (42.4 acres), an average of 1.3 per acre. In 1976 the average was 1.2 nests per acre.

Searches in 1977 on the 90 FCGR plots (57.7 acres) recorded 126 nests, 2.2 per acre, a substantially greater average density than the 1 nest per acre found in 1976.

Of the 181 songbird nests found on roadside plots on the two study areas in 1977, 172 (95 percent) were identified as nests of red-winged blackbirds. Three nests were unidentified, and the other six were found to be nests of dickcissels, a vesper sparrow, and a meadowlark.

Nest searches in 1976 and 1977 indicate that existing roadside management practices are beneficial to populations of songbirds in east-central Illinois. However, the breeding behavior and biology of songbirds in managed roadside vegetation (brome-alfalfa and other suitable species) and in nearby cover types should be intensively studied. These studies would advance our understanding of territorial behavior, the use of roadsides by various species, the phenology of nesting, and the success of nests and fledglings. Information of this nature would enable biologists to manage roadsides more effectively for both songbirds and pheasants.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

Supplemental feeding of squirrels usually involves placing either whole ear corn or whole kernel corn in or adjacent to a forest. Corn is cheap and easy to obtain. It may be grown adjacent to the forest and left as part of a sharecropping agreement. Also, squirrels seem to relish it as food; they will eat some corn even when tree seed crops are abundant. But, is corn an adequate food supplement for squirrels?

RESEARCH AND DEVELOPMENT DIVISION

Project: Roadside Wildlife Management

Report of the progress of the project during the period from 1/1/68 to 12/31/68.

Prepared by: J. B. Hume, Jr.

Submitted: 1/1/69

Reviewed by: J. B. Hume, Jr.

The project was initiated in 1967 to study the effects of roadside management on wildlife. The project was divided into three phases: (1) a preliminary survey of roadside habitats, (2) a study of the effects of roadside management on wildlife, and (3) a study of the effects of roadside management on the economy.

The project was completed in 1968. The results of the project are presented in this report. The project was funded by the Department of the Interior, Bureau of Land Management.

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Submitted: 1/1/69

Reviewed by: J. B. Hume, Jr.

The project was completed in 1968. The results of the project are presented in this report. The project was funded by the Department of the Interior, Bureau of Land Management.

When corn was fed to adult female fox squirrels held under simulated winter temperatures and photoperiods, we found that corn embryos (squirrels usually eat only the germ portion of a kernel of corn) were low in sodium and calcium, contained average amounts of potassium and nitrogen, and were high in magnesium and phosphorus compared with acorns and hickory nuts. The coefficient of digestion (amount of food digested) for corn was significantly ($P < 0.05$) lower than the coefficients for mast foods. Squirrels on a corn diet lost the most weight per day (-2.9 g) and had the lowest amount of metabolized energy for any of the diets tested. Corn germ had a low value of fat, an average value of protein, and a high value of carbohydrates compared with acorns and hickory nuts.

On the basis of our studies and on others that have examined the benefits of a corn diet to squirrels, it appears that corn is not an acceptable winter food for fox squirrels despite their evident liking for it. Corn would be particularly detrimental in years of mast failure, when squirrels would be forced to eat corn exclusively. In light of these test results, what happens to a squirrel population that is fed corn during the winter? In the next research letter we will examine the results of such a feeding program.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

On 20 December 1977, 80 acres were added to the 560-acre sanctuary system in Marion County. This purchase, the first made since December 1974, was the culmination of nearly 2 years of negotiating with the seller, the buyers, The Nature Conservancy (TNC), and the Survey.

A 20-acre portion of the 80-acre tract was donated to TNC by the seller--a contribution worth a minimum of \$25,000. This is the second time the seller donated 20 acres to TNC for prairie chickens. As before (1969), the seller will likely be given the right to give the tract a name of her choosing.

The 60-acre portion of the tract was purchased at the appraised price of \$1,100 per acre (fall 1976) by private conservationists, including a gentleman originally from Illinois but now living in Ohio, and his mother and sister. The buyers have leased the 60 acres to TNC and they hope ultimately to donate part or all of the tract to TNC. Because the date of closing was less than 90 days before 1 March, the present tenant is entitled to carry through any plans (continued grain farming and heavy grazing) he had for the 1978 crop year. However, the tenant will probably agree to a limited acreage of grass seedings in the spring of 1978, so that some nest cover will be present on the tract by the spring of 1979.

A small booming ground (three males) was located on the new tract in 1977, and the tract is within an area documented by this project as high-use prairie chicken range since 1963. Also, the new acquisition is located about 1 mile from the nearest established sanctuary. The five units totaling 640 acres now composing the sanctuary system in Marion County are distributed over a 6-mile range between Stephen A. Forbes State Park and Kinmundy and Farina.

The first of these is the fact that the population of the United States is increasing at a rapid rate. This is due to a number of factors, including a high birth rate, a low death rate, and a large influx of immigrants from foreign countries.

The second factor is the fact that the population of the United States is becoming more and more diverse. This is due to the fact that people from many different countries are moving to the United States, bringing with them their own customs, languages, and ways of life.

The third factor is the fact that the population of the United States is becoming more and more urban. This is due to the fact that people are moving from rural areas to cities in search of better jobs and living conditions.

The fourth factor is the fact that the population of the United States is becoming more and more educated. This is due to the fact that more and more people are attending school and college, and are acquiring higher levels of education.

Geography of the United States

The United States is a large country with a diverse geography. It has a long coastline along the Atlantic Ocean, the Gulf of Mexico, and the Pacific Ocean. It also has a large area of landlocked territory in the interior.

The United States is a country with a diverse climate. It has a wide range of temperatures, from very hot in the south to very cold in the north. It also has a wide range of precipitation, from very dry in the west to very wet in the east.

The United States is a country with a diverse topography. It has a wide range of elevations, from very low in the coastal areas to very high in the mountain regions. It also has a wide range of landforms, including mountains, rivers, and lakes.

The United States is a country with a diverse flora and fauna. It has a wide range of plant and animal life, from tropical rainforests in the south to tundra in the north. It also has a wide range of natural resources, including oil, coal, and minerals.

The United States is a country with a diverse population. It has a wide range of ethnicities, from white to black to Hispanic to Asian. It also has a wide range of religions, from Christianity to Judaism to Islam to Buddhism.

The United States is a country with a diverse economy. It has a wide range of industries, from agriculture to manufacturing to services. It also has a wide range of income levels, from very poor to very rich. It also has a wide range of social problems, including poverty, crime, and drug abuse.

The United States is a country with a diverse history. It has a long and complex past, with many different events and people shaping its development. It also has a wide range of cultural traditions, from Native American to European to African.

The United States is a country with a diverse future. It has many challenges ahead of it, including a growing population, a changing climate, and a global economy. It also has many opportunities, including a rich natural resource base and a highly educated workforce.

The United States is a country with a diverse present. It is a land of many different people, places, and things. It is a land of opportunity and hope, and it is a land that is always changing and growing.

Because of soaring prices of farmland, the original goal of 1,500 acres of sanctuaries for prairie chickens in both Jasper (now 1,001 acres) and Marion counties may no longer be realistic. TNC offered \$1,400 per acre for another 80-acre parcel adjoining the 160-acre Butler Sanctuary in Marion County, but this tract was sold to a farmer for an estimated price of \$1,500 per acre. Sales exceeding this figure are now commonplace for farmland in Jasper and Marion counties.

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February, 1978

Vol. 21, No. 2

Manipulation of Pheasant Habitat

R. E. Warner

The Ford County Management Unit (FCMU) was established in 1968 as a pilot study of the potential of a block approach to roadside seeding in relation to feasibility of management by the Department of Conservation (DOC), compliance by cooperating farmers, and responses by the local population of pheasants. One consideration with implications for all three aspects of the study is how much change there will be in farmer control of the roadsides over a period of years.

Changes in farm operators on the FCMU over the past 10 years may exemplify the turnover that can be anticipated in developing a large-scale roadside management program in east-central Illinois. Changes in farmers on the 20-mi² area were identified by comparing records at the Ford County Agricultural Stabilization and Conservation Service (ASCS) office for 1968, 1975, and 1978. A few recent changes on the FCMU not yet recorded at the ASCS office are included in our present evaluation. In 1968, 65 individuals on the area were farming a total of 96 different parcels of land, as recorded at the ASCS office (most individuals farmed more than one section of land). From 1968 to 1978, farm operatorship had changed on 42 (43.8 percent) of these parcels of land. Farm changes involved 29 individuals, 44.6 percent of the number farming on the area in 1968. Over the 10-year period 10 farmers have moved into the FCMU, comprising about 15 percent of the farmers currently on the area.

Change in farm operatorship on the FCMU signifies change in control of managed roadsides. Since 1968, farm turnover has affected the control of 28.3 (38.8 percent) of the 73 miles of seeded roadsides. Most of these changes involved initial (1968) cooperators in the roadside program; only 9.5 miles (13 percent) are presently controlled by farmers that moved into the area after 1968. Except for two recent changes, farmers new to the roadside management program have been solicited for their cooperation. Non-cooperators on the FCMU in 1968 are now farming land abutting 1.8 miles (2.5 percent) of the roadside seedings.

Thus, over the decade of the FCMU's existence, changes in farm operators have averaged about three per year. This number corresponds to an average annual change in the control of 2.9 miles of seeded roadsides, or 3.9 percent

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of the 73 managed miles. Each year, an average of about 1 mile (1.3 percent) of seeded roadside became controlled by a farmer new to the FCMU. The implications of these findings for a long-term roadside management scheme will be considered in next month's newsletter.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

We fed shelled corn to a mixed population of gray and fox squirrels for three consecutive winters to examine the effects of a supplemental winter feeding program on squirrels in Illinois. We used two 30-acre study areas located in mature mixed upland hardwoods, one provided with feeders (one per 8 acres), the other serving as a control. We supplied corn for 12 weeks in 1974-75, 17 weeks in 1975-76, and 28.5 weeks in 1976-77. Squirrels were livetrapped in the fall before feeding began and again in the spring after feeding was completed. Captured squirrels were ear-tagged, sexed and aged, examined for breeding condition and diseases or parasites, and weighed to the nearest 0.1 g before release.

The feed area had a higher density of squirrels both before and after feeding began, due to a significantly higher number of gray squirrels on the area. The numbers of fox squirrels on the two areas were not significantly different. On both study areas, more squirrels were captured in the spring than in the fall. In none of the 3 years nor in the 3 years combined was there a significant difference between areas in the total number of fall-captured vs. spring-captured squirrels.

There were no significant differences in body weight between feed and control areas for any sex- and age-class. In general, body weights were higher on the control area in the spring, with control area squirrels showing less weight loss between fall and spring.

Spring breeding rates also did not differ significantly between areas, with 84 percent of the yearling and adult females breeding on the feed area and 83 percent of the potential breeders reproductively active on the control area.

Recapture rates, squirrels tagged in one trapping period and retrapped in the next trapping period (6 months later), also did not differ significantly between areas, but recapture rates were generally higher on the control area.

There was also no significant difference in the fall and spring frequency of mange between areas. Mange was more prevalent on the control area and more prevalent in the spring than during the fall on both areas.

Fox squirrels were collected from both areas in the spring of 1977 and analyzed for amounts of carcass fat, kidney fat, and liver fat. There was no significant difference between areas for any of these indices, although squirrels on the control area were generally fatter than those collected on the feed area.

The first group of experiments was designed to determine the effect of the concentration of the solution on the rate of reaction. The results are shown in Table I.

The second group of experiments was designed to determine the effect of the temperature on the rate of reaction. The results are shown in Table II.

The third group of experiments was designed to determine the effect of the catalyst on the rate of reaction. The results are shown in Table III.

The fourth group of experiments was designed to determine the effect of the solvent on the rate of reaction. The results are shown in Table IV.

The fifth group of experiments was designed to determine the effect of the pressure on the rate of reaction. The results are shown in Table V.

The sixth group of experiments was designed to determine the effect of the time on the rate of reaction. The results are shown in Table VI.

The seventh group of experiments was designed to determine the effect of the concentration of the reactants on the rate of reaction. The results are shown in Table VII.

The eighth group of experiments was designed to determine the effect of the concentration of the products on the rate of reaction. The results are shown in Table VIII.

The ninth group of experiments was designed to determine the effect of the concentration of the catalyst on the rate of reaction. The results are shown in Table IX.

In summary, we could not demonstrate any significant benefits of winter feeding shelled corn on our study area. Naturally occurring foods were average to above average during the 3-year study. The 1976-77 winter was unusually severe; the two previous winters were of average severity.

We believe that feeding corn was actually somewhat detrimental to the squirrels. We base our belief on the lower weights and carcass fat indices found in squirrels on the feed area in the spring of 1977, compared with the control area squirrels. As we pointed out in a previous newsletter (MWRL 20(11):2), our penned fox squirrels lost weight on a pure diet of corn. Other studies have also found weight loss associated with a corn diet. Squirrels usually eat only a single item at each meal; if they became addicted to shelled corn to the exclusion of natural foods, which seems likely, a weight loss such as we demonstrated would be expected.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

As reported in MWRL 19(10):3, a new technique for measuring vegetative structure in sanctuary grasslands apparently could distinguish between fields subject to different management methods. After 2 years of using this technique, we also found that structural differences in fields were related to the nest density of prairie chickens.

In 1976, cover in fields containing more than one prairie chicken nest had a mean maximum height (MMH) of 90.3 cm and a mean percent occurrence (density) of 22.4 percent. Cover in fields with no nests had an MMH of 46.8 cm and a density of 13.1 percent.

In 1977, fields containing more than one nest had a cover MMH of 77.5 cm and a cover density of 15.7 percent. In fields with one nest, the MMH was 60.7 cm and the density was 12.4 percent. Fields with no nests had an MMH of 41.5 cm and a density of 11.7 percent.

These data have not been statistically analyzed because of the difficulties in calculations involving unequal and disproportionate subclass numbers. Nevertheless, two things are evident in the data. First, prairie chickens tend to nest in the tallest, most dense cover available on the particular sanctuary complex studied (Yeatter, Field, and McGraw sanctuaries). These data do not negate the possibility that some cover types are too tall and dense for prairie chickens to utilize as nest cover. They indicate only that such cover did not exist on the area studied in 1976 and 1977. Second, the cover available in 1977 was shorter and more sparse than the cover available in 1976. The drought in 1976 resulted in poorer growth and, hence, less residual cover in spring 1977.

On the basis of these observations, our management should provide as much tall, dense residual cover as possible. In 1976 and 1977 these cover qualities were found in undisturbed stands and in stands harvested for grass seed (MWRL 19(10):3).

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

March, 1978

Vol. 21, No. 3

Manipulation of Pheasant Habitat

R. E. Warner

The last newsletter (MWRL 21(2):1) indicated that over the past decade turnover in farm operators on the Ford County Management Unit (FCMU) has resulted in changes in control of 28.3 (38.8 percent) of the 73 miles of seeded roadsides; 9.5 of these miles (13 percent) are presently controlled by farmers that have moved onto the area since 1968. These newcomers have had no previous experience with the Department of Conservation's (DOC) roadside management program, and contacts with these individuals have thus been considered significant in the overall cooperation given by farmers on the FCMU.

Follow-up procedures regarding such farmer changes merit consideration in a large-scale roadside management program. Two obvious measures are involved in a prospective follow-up plan: (1) identifying changes in farmer control of seeded roadsides, and (2) contacting newcomers in an attempt to secure their cooperation. As a pilot study of the feasibility of follow-up efforts, Ford County has been selected as an initial area of focus because many of the roadsides seeded by the DOC over the past 5 years are located there.

The Ford County Agricultural Conservation and Stabilization Service (ASCS) maintains a file of changes in farm owners and tenants over approximately the last 3 years. All county ASCS offices have similar records. Notations of farmer changes in Ford County will be compared with a master list of roadside seedings (recorded by location and name of farmer) maintained by W-85-D personnel. Contriving this procedure for the Ford County seedings will permit the DOC to determine how the identification process can be expedited--computerized methods may be applicable. We will also be able to learn how often this procedure should take place; it is estimated that once every few years would be sufficient. Finally, we will be able to learn appropriate methods of indoctrinating newcomers to the importance of managed roadside areas and what percentage of these newcomers can be expected to cooperate in roadside management.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

As we pointed out in the last newsletter (MWRL 21(2):2), we could find no significant difference in density, carcass fat, body weight, incidence of mange, and breeding rates between squirrels fed shelled corn for three consecutive winters and squirrels eating only natural foods in mature mixed hardwoods. Might squirrels living in younger hardwoods benefit from food supplements? To find out, we set up two 20-acre study areas at Lake Shelbyville. On one area we put two feeders

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(one per 10 acres) and fed shelled corn for two winters, for 16 weeks in 1975-76 and for 28.5 weeks in 1976-77. The other area served as a control.

We livetrapped both areas in spring only. Captured squirrels were ear-tagged, sexed and aged, weighed to the nearest 0.1 g, and examined for diseases and parasites and for breeding condition. In the spring of 1977 we collected several fox squirrels from each area and analyzed them for percentage carcass fat and liver fat.

The first spring (1976) we captured 15 squirrels on each area. The second spring we captured 26 squirrels on the feed area and only 15 on the control, a substantial difference. However, we were not aware that the control area had been opened to hunting in the fall of 1976 until a hunter reported killing an ear-tagged squirrel. Thus, an unknown number of control area squirrels may have been shot in the fall of 1976.

There were no significant differences in body weights for squirrels captured on each area in the spring. Body weights were higher on the feed area.

Breeding rates for breeding age females were higher on the control area (100 percent, $N = 8$) than on the feed area (81 percent, $N = 16$). However, the ratio of young-to-old squirrels was much higher on the feed area (7.5 young per adult) compared with the control (2.7 young per adult) area.

Mange was more common on the feed area (24 percent, $N = 41$) than on the control area (13 percent, $N = 30$) among captures from both spring trapping periods.

Fox squirrels from the feed area had higher values for carcass fat but lower values for liver fat than control area squirrels.

The evidence is far from conclusive that shelled corn materially benefited the squirrels inhabiting the young forest at Lake Shelbyville.

Squirrels on the feed area had more carcass fat and weighed more than control area squirrels, which had a lower incidence of mange and a higher rate of breeding. The higher recovery rates and density on the feed area were probably the result of hunting on the control area and cannot be taken as due solely to the feeding program.

We do not believe that winter feeding of squirrels is justified during most winters in the Midwest. The many food-producing species that make up the hardwood forest insure that nearly always some species will produce seed. A total seed failure is almost unknown in the Midwest. However, where cutting has removed many of the species that formerly occurred in the hardwood forest, local seed shortages can occur. Such shortages are fairly common in the bottomland forest where loggers have removed many of the better squirrel food species and created near-monotypes. On such areas, winter feeding may occasionally be justified, but we do not recommend the use of shelled corn in a feeding program. Soybeans appear to be a more nutritious diet, although some squirrels may not readily eat them. If feeders are used, a density of one feeder per 8-10 acres seems to be adequate to provide all resident squirrels access to the supplemental food.

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Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Redtop (Agrostis alba) provided a "substitute prairie" for prairie chickens as early as 1867 in southeastern Illinois. Redtop is easily established and the meadows are easily managed by seed harvesting--provided the market price is sufficient to offset the costs of combining. In good years, income from redtop harvests can substantially defray the costs of sanctuary management. Of vital importance is the timing of the redtop harvest (late July), which is well after the critical nesting and brood-rearing season. Thus, we continue to use redtop as the dominant grass in seedings for nest cover.

Since 1963, the 2,506 acres of redtop that have been searched on the sanctuaries at Bogota have yielded a total of 318 prairie chicken nests for densities of 1.3 total nests and 0.7 hatched nest per 10 acres. Nest success has averaged 54.2 percent in redtop.

Timothy (Phleum pratense) was more readily accepted by nesting hens than redtop. A total of 117 nests were found in 693 acres dominated by timothy, yielding densities of 1.7 total nests and 0.9 hatched nest per 10 acres, and an average nest success of 56.6 percent. However, the low market price of timothy seed usually does not provide sufficient income to warrant seed harvesting. Like redtop, unmanaged stands of timothy are quickly invaded by weeds. Management of timothy by haying during the time when hay quality is best is not feasible because of the danger to late nests and young broods. Also, the regrowth of timothy after haying is generally insufficient to provide adequate nest cover for the next spring. Haying also depletes soil fertility. For these reasons we include timothy in new redtop seedings, but we attempt to have redtop sufficiently dominant in the resulting sod to make combining for seed feasible.

Use of brome (Bromus inermis), though limited to date, has provided some encouraging data on use by nesting prairie chickens. A total of 48 nests have been found in 192 acres of brome, for densities of 2.5 nests and 1.3 hatched nests per 10 acres--nearly twice as high as for redtop. Nest success averaged 52.5 percent in brome. Management of brome on the sanctuaries has been largely limited to periodic prescribed burning. Brome appears more resistant to invasion of weeds than redtop or timothy, which reduces the need for seed combining or haying as a means of management. Thus, we are giving greater consideration to the use of brome on the sanctuaries.

Although prairie chickens readily accept exotic grasses, it seems axiomatic that the establishment and maintenance of native vegetation should be emphasized in prairie chicken management. To date, however, results with native grasses have been disappointing. In a total of 311 acres of prairie grasses, 33 nests were found--an average of 1.1 nests but only 0.4 hatched nest per 10 acres and only 33.3 percent nest success. Most of these stands were dominated by switch grass (Panicum virgatum), with lesser amounts of big bluestem (Andropogon gerardi) and Indian grass (Sorghastrum nutans) present. Burning, mowing for weed control or seed, and more recently, mowing for hay have been the primary forms of managing prairie grasses. We hope to add some limited grazing to this list in 1978. Also, greater diversification of the prairie vegetation on the sanctuaries and reduced emphasis on switch grass seem desirable in order to achieve better acceptance and success by nesting hens.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

April, 1978

Vol. 21, No. 4

Manipulation of Pheasant Habitat

R. L. Warner

An evaluation of the harvest of pheasants on the Sibley Study Area (SSA) in the 1960's indicated that from 1962 to 1968 an average of 6.7 percent of the early fall population of hen pheasants was bagged (illegally) by hunters during the upland game season; the percentage for the seasons of 1962 and 1963, when peak numbers of pheasants (and hunters) were observed on the SSA, was 9.0. The average illegal hen kill dropped to about 5 percent in 1967 and 1968, corresponding with a moderate decline in the numbers of pheasants and hunters. In most Midwestern and Plains states, reduced hen kill appears to be a typical pattern of response to declining populations of pheasants. However, some workers have expressed the belief that when lows occur in pheasant abundance, proportionately greater numbers of hens are shot. Although this was not the case on the SSA in the 1960's, the density of ringnecks in the east-central counties of the state in recent years has been only a fraction of that noted a decade ago, and for this reason the current level of illegal hen kill merits attention.

The below-average harvest of cocks and numbers of hunters afield in 1977 reflected the scarcity of pheasants (MWRL 20(11):1); winter sex ratios of 46 cocks per 100 hens were indicated on several areas of investigation in Ford, Champaign, Iroquois and McLean counties after the 1977 upland game season. The sex ratio for the east-central counties has averaged slightly less than 30 cocks per 100 hens since 1968.

To ascertain if recent declines in the abundance of cocks has prompted hunters to shoot more hens, pheasants found road-killed or frozen in the field were collected over the past few months. Although considerable effort was expended by staff members of the Department of Conservation and Natural History Survey, only 25 ringnecks (8 cocks and 17 hens) were gathered for fluoroscopy. Most of these pheasants were found on or near the five study areas located in the counties listed above. The fluoroscoped sample was too small to afford a calculation of the percentage of hens shot by hunters. Only one pheasant (a hen) was found to contain lead pellets, which seems to reflect the unusually low hunter pressure in 1977. It would be logical to expect that more than one hen would contain lead shot if illegal hen shooting had increased to critical proportions.

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As populations of pheasants have declined in Illinois' prime range, hunters have spent fewer hours afield and have harvested a smaller portion of the cock population. Populations of pheasants could sustain substantially higher rates of cock harvest in this state. There is no evidence, based on data from the SSA in the 1960's and the small sample collected from several study areas over the past year, that the illegal shooting of hens increases when numbers of pheasants are low.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

Wildlife managers frequently recommend that some corn and soybeans remain unharvested in the fall to provide winter food and cover for a variety of wildlife species. When unpicked rows are adjacent to woodlands, they may provide supplemental food for gray and fox squirrels.

To evaluate use of unharvested grain by squirrels, we studied squirrel use of unharvested corn in two fields in McLean County and unharvested soybeans in one field in Shelby County during the winter of 1975-76. There were four study plots 30 m long in the six rows of standing corn. On 12 September, 22 November, 12 February, and 7 April, the study plots were checked for the total number of ears of corn, the numbers of ears aboveground and on the ground, and the number of ears eaten by wildlife. The outer 30 m of the adjacent woodland were searched for fresh corncobs at each visit.

We found that animal usage of unharvested corn was highest in late winter and early spring. In February, only 57 ears had been recently eaten by wildlife; in early April, 109 ears had recently been consumed.

Tracks after snowfalls in December and January indicated that squirrels typically fed on osage orange, hickory nuts, and acorns at the edge of the adjacent woods and did not enter the cornfield. On one occasion, a squirrel passed through the standing corn to feed on combined corn. White-tailed deer, raccoons, and mice ate most of the corn that was used by wildlife.

The unharvested soybeans were adjacent to mature oak-hickory. As far as we know, squirrels did not use the soybeans. At least, we never found any squirrel tracks in the rows of soybeans after snowfall. By April, 80 percent of the soybeans had been removed by other wildlife including deer, quail, pheasants, cottontails, and mice.

On the basis of our studies, several rows of unharvested corn adjacent to timbered areas offer no more benefits to squirrels than would be available in the field combined but not fall plowed. In most years, forests provide sufficient food, and squirrels use corn only occasionally. Combined fields provide enough corn for this occasional feeding. A pure corn diet is not an adequate food for wintering squirrels.

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A better case can be made for leaving unharvested soybeans for squirrels even though some wild squirrels do not like them. They are more nutritious as a winter food than corn and are more accessible after snowfall if left unpicked.

Food supplies for both species of squirrels are best insured through protection and enhancement of Illinois' existing forests. Many of the forests on Illinois' public lands are young, dating only from the land abandonment during the Great Depression. With continual protection, these forests will provide improved squirrel habitat. If these areas are to be logged, careful consideration must be given to the needs of wildlife after any timber sale. In view of the continuing destruction of Illinois' privately owned forests, land managers must strive to insure the continued growth of forests on public lands. Properly managed, these forests will shelter increasing numbers of squirrels in future years, without recourse to supplemental winter feeding.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

The prairie chicken population on the Bogota Study Area was censused in the spring of 1978 for the 16th consecutive year. As in past springs, booming ground surveys were conducted along with supplementary observations made by visitors in blinds almost daily from 25 March through 23 April.

Counts made this spring (1978) yielded a total of 74 cocks, essentially unchanged from the count in 1977 (75 cocks). As previously noted (MWRL 18(9):4), success of the hatch must be about 50 percent to maintain a stable population. The 59 percent rate of success of nests last summer led to the prediction of population stability for this spring (MWRL 20(8):3).

Although the population is unchanged from last year, the distribution of prairie chickens at Bogota has changed. This year 78 percent of the population was found on the Yeatter, Field, and McGraw sanctuaries, only 23 percent of the total sanctuary acreage. The booming ground on the Donnelley Sanctuary declined from its usual 20-30 cocks to only 9 cocks this spring. The persistence of severe winter weather this year may not have allowed sufficient time for the usual spring dispersal. The major wintering flock of prairie chickens centered on the Yeatter-Field-McGraw unit.

The extended winter apparently also affected the breeding cycle. Hens first appeared on the booming grounds about 1 week later than normal this spring. The first mating was observed on 7 April this spring and on 20 March in 1977. However, the peak of matings occurred on 11 April this spring, about 5 days later than usual.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

May, 1978

Vol. 21, No. 5

Manipulation of Pheasant Habitat

R. E. Warner

Roadside management efforts are being evaluated relative to responses by populations of pheasants and songbirds and cooperation by participating farmers. These investigations are under way in conjunction with seeded roadside programs. However, we do not know the degree of cooperation that can be expected from farmers when no seeding is done and they are requested by the Illinois Department of Conservation to delay or eliminate roadside mowing, nor do we know the best way to obtain their cooperation.

As a first step in gaining this information, an attitude survey was formulated and distributed to upland game hunters in 1977. The questionnaire was conducted as a project in a class in Agricultural Policies and Programs at the University of Illinois. The purpose of the one-page survey was to measure the attitudes of a group supportive of game management regarding the relative importance of seven game management policies/programs (GMP) and eight agricultural policies/programs (AP) for increasing populations of upland game in central Illinois. Respondents could answer all 15 questions by marking them as "not important," "somewhat important," or "very important" for increasing upland game. Eliminating or delaying roadside mowing was categorized in the analysis as an AP. The questions were not identified as either AP or GMP on the questionnaire.

Three hundred copies of the questionnaire were distributed among seven stores where upland game licenses were sold in Champaign, Douglas, and Ford counties; store merchants agreed to ask hunter licensees to fill out the questionnaire over-the-counter. However, merchants were often hesitant to make this request of licensees, and for this reason only 66 completed forms were collected 1 week after the opening of the 1977-78 upland game season. Sixty-three of the completed forms were filled out by residents of central Illinois; 16 of these residents owned or rented farmland.

A significantly greater ($p < 0.005$) portion of the farmers considered AP to be "not important" for increasing upland game than did nonfarmers. Farmers ranked the eight AP as follows, in order of declining importance: leaving vegetation undisturbed along waterways, minimum tillage/fall plowing, participation in a set-aside program, controlling spread of urban areas, eliminating or delaying roadside mowing, and restricting use of agricultural chemicals. For nonfarmers, delaying roadside mowing was ranked as more important than controlling the spread of urban areas and restricting the use of agricultural chemicals. Seventy-five percent of the farmers and 98 percent of the nonfarmers indicated that eliminating or delaying roadside mowing was either somewhat or very important for increasing upland game.

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No significant difference was detected ($P > 0.10$) in farmer and nonfarmer attitudes regarding the seven GMP questions. Licensees indicated that, in order of diminishing importance, controlling bag limits for upland game, stricter enforcement of game laws, controlling the length of the hunting season, stocking upland game on private lands, increasing hunting license fees, put-and-take shooting on state areas, and removal of predatory animals would result in more upland game. The 63 licensees (farmers and nonfarmers combined) ranked delayed roadside mowing eighth in importance. The hunters considered five of the seven GMP to be less important for increasing upland game than delayed roadside mowing.

The restricted sampling technique of this study prohibits making definitive conclusions about the attitudes of licensees, but some thought-provoking questions arise with regard to differences evident in farmer and nonfarmer thinking. Relative to more traditional GMP, licensees considered delayed roadside mowing to be important for increasing populations of upland game. The findings of this study could be helpful in devising a more sophisticated study of the views of the rural sector regarding delayed roadside mowing. Such a study could be the basis for developing an educational thrust that would significantly alter roadside mowing patterns in Illinois.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

Body composition, organ weights and condition indices, all useful indicators of the health of an organism, have not been reported for the fox squirrel. In the course of our squirrel studies, we have had the opportunity to collect and autopsy fox squirrels during each month of the year, although the bulk of our samples occur either in the fall (August-October) or spring (February-April).

We found that adult male and female fox squirrels had almost identical average external body measurements and body weights. Adult females had an average body weight of 780.5 g and adult males a weight of 775.1 g.

Body fat was highest in February (12.6 percent) and lowest in August (4.5 percent). Fox squirrels averaged 6.9 percent carcass fat for specimens that appeared in good condition.

In fox squirrels, liver fat does not appear to be as good an indicator of body condition as carcass fat or a kidney fat index (the ratio of the weight of surrounding fat to the weight of the kidneys).

Winter is usually considered to be the critical period for fox squirrels. We compared body condition of squirrels collected in fall with that of squirrels collected in early spring. Only two comparisons between spring and fall were significant. Adult fox squirrels collected in the fall ($N = 30$) had a significantly ($P < 0.05$) higher percentage of liver fat than those collected in the spring ($N = 81$), whereas adult fox squirrels collected in the spring ($N = 67$) had a significantly higher percentage of carcass fat than the fall sample ($N = 34$).

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1. The first thing I noticed when I stepped out of the plane was the fresh air. It felt like a warm blanket after a long journey. The sun was shining brightly, and the birds were chirping happily. I took a deep breath and smiled. This was my chance to start a new life.

1. Teamwork : Good (4.0/5.0) Very Good (4.5/5.0)
 2. Originality : Good (4.0/5.0) Very Good (4.5/5.0)

Fox squirrels in the fall had a slightly higher average body weight and kidney fat index. Apparently, adult fox squirrels were in as good physiological condition in the spring as during the preceding fall during 1976 and 1977, the 2 years when we collected squirrels.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

A total of 124 prairie chicken cocks were counted on five census areas in four counties of south-central Illinois in the spring of 1978. This total was 9 percent lower than counts made on the same census areas in 1977. The census effort again covered all areas of Illinois known to contain remnant flocks.

The flock at Bogota in Jasper County was essentially unchanged, with 75 cocks in 1977 and 74 cocks in 1978 (MWRL 21(4):3), but remained 22 percent below the long-term mean, which dates back to 1963. The sanctuary acreage supporting the flock at Bogota totals 1,001 acres.

In Marion County the flock near Farina declined from 30 cocks in 1977 to 21 cocks in 1978, a drop of 30 percent. The Farina flock is 33 percent below the long-term mean, which also dates back to 1963. The main support for this flock has been the 140-acre Lacey-Loy Sanctuary Unit. The 100-acre Loy unit should become an additional support for this Farina flock, beginning this year, although the nearest booming ground remained 0.75 mile from this tract. The newly acquired (December 1977) Lacey-Perbix 80-acre unit (MWRL 21(1):2-3) should provide 30 acres of nest cover of fair quality by the spring of 1979. This spring, single prairie chicken cocks boomed in three separate locations around 124 acres of weedy wheat stubble near this new sanctuary unit. Such cover is usually plowed too soon to allow for hatching of prairie chicken nests.

The flock near Kinmundy (Marion County) declined from 24 cocks to 17 cocks, a drop of 29 percent. However, the Kinmundy flock is 19 percent above the long-term mean, which dates back to 1964. The flock at Kinmundy was again well established on both the 160-acre Survey Sanctuary (10 cocks) and the 160-acre Butler Sanctuary (7 cocks), which provide the primary nest habitat in this area.

Two unmanaged flocks remain perilously close to extinction; however, both showed an increase since last spring. The flock at Mt. Erie in Wayne County increased from 2 cocks in 1977 to 5 cocks in 1978 but remained 66 percent below the long-term mean, which dates back to 1963. The flock near Hoyleton in Washington County contained 6 cocks in 1977 and 7 cocks in 1978. The 1978 count was 13 percent above the long-term mean, which began in 1969. Both flocks are probably so low that one or two hatches (in contrast to none) can increase or at least maintain the population levels.

Erratum: The date of 20 March 1977 given in the last paragraph, MWRL 21(4):3, should have read 30 March 1977.

JUL 14 1978

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Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

June, 1978

Vol. 21, No. 6

Manipulation of Pheasant Habitat

R. E. Warner

A census of breeding pheasants in 1978 was conducted on five areas in a cooperative effort between biologists from the Illinois Natural History Survey and the Department of Conservation. These areas included the Ford County Management Unit (FCMU), the Sibley Study Area (SSA) in Ford County, Anchor Township in McLean County, Harwood Township in Champaign County, and Prairie Green Township in Iroquois County. Audio censusing of cock pheasants was conducted on all areas in May 1978. In addition, visual counts of pheasants were made on the SSA and FCMU in late April and May. The SSA and FCMU have traditionally been censused as a part of this project; censusing of the other areas commenced in 1976. Roadsides in the FCMU were seeded in 1968, Anchor and Harwood townships in 1976, and Prairie Green in 1977.

A decline in numbers of pheasants was noted for all areas in May 1978 from populations censused 1 year ago. Visual counts on the SSA and FCMU indicated 6.4 and 6.9 cocks, respectively, per 100 miles of driving in 1978, down 71.8 and 77.6 percent from the numbers observed in 1977. This difference in numbers of pheasants between the 2 years may be partially attributed to the unusually wet weather during early morning hours in April and May, which is not conducive to making accurate visual counts. The audio counts suggested declines of 25.0 percent (SSA) and 14.5 percent (FCMU) over the same period. In past years, audio and visual counts on these areas have been similar in reflecting the relative abundance of the ringneck (MWRL 20(7):1-2).

Audio counts in 1978 on the Anchor, Harwood, and Prairie Green areas indicated 3.6, 6.2, and 3.0 calls per 2-minute stop, respectively, compared with 2.1 calls and 6.5 calls per 2-minute stop on the SSA and FCMU. Relative to last year, the number of cock calls on the three areas declined 14.5 percent (Anchor), 12.7 percent (Harwood), and 67.4 percent (Prairie Green).

As of the previous reproductive season (1977), the recently seeded roadsides in the three townships were not established in mature nest cover. The FCMU, with mature roadside seedings, had about twice as many cock calls as the other areas, with the exception of the Harwood area. The Harwood and FCMU areas had similar numbers of cocks. The Harwood area was selected for management in order to evaluate the potential benefits of locating seedings where protective winter cover was relatively abundant. The unusually severe weather the past two winters has afforded such an evaluation. In the spring of 1976, fewer cock calls were heard on the Harwood area than in any of the other areas. However, storm-related declines in this area have been substantially less than for the other four areas, with the result that this area in May 1978 had one of the highest pheasant populations of the five areas that were censused.

UNITED STATES DEPARTMENT OF AGRICULTURE

OFFICE OF THE SECRETARY

WASHINGTON, D. C.

May 1, 1911

Dear Sir:

Very truly yours,

John D. Smith

Enclosed

Very truly yours,

I have the honor to acknowledge the receipt of your letter of the 28th inst. in relation to the matter of the proposed amendment to the act of March 3, 1907, relating to the exportation of certain agricultural products. The Department is at present considering the same and will advise you as soon as a decision has been reached.

I am, Sir, very respectfully,
Your obedient servant,
John D. Smith
Secretary

Very truly yours,
John D. Smith
Secretary

Very truly yours,
John D. Smith
Secretary

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

The hickories as a group (including shagbark, pignut, mockernut, and bitter-nut) rank third in abundance among tree species in Illinois. Hickory seed is a favored squirrel food, high in nutrition and abundant throughout the upland forests of the Midwest.

However, little has been published regarding seed production for the genus (except for the commercially important pecan), probably because the nuts are not commercially valuable and hickory wood is little used for lumber products. Such questions as frequency of seed crops, seed-bearing age, and the effects of climatic factors on seed production have not been investigated. Without some information regarding seeding habits, it is difficult to recommend hickory stocking levels to foresters and wildlife managers who desire to improve forested habitats for squirrels.

For the past 6 years (1972-1977), we have monitored seed production levels of selected forest-grown shagbark, mockernut, and pignut hickories. We used two 33-gallon barrels placed at random under each tree to collect seed. All trapped seed was examined after seed fall was complete in late November and was sorted into three groups: sound, unsound, or aborted.

As has been shown for the oaks, seed production for our sampled hickories was variable among years, species, and individual trees. For shagbark ($N = 9$ trees), an average of only 29.6 percent (16/54 for 6 years) of the trees produced at least some sound seed during our study. No seed was produced in 1974, but two-thirds of the trees produced seed in 1977, the best seed year for shagbark for the 6 years examined. For pignut hickory ($N = 18$ trees), an average of 40.0 percent of the trees produced sound seed, ranging from only 5.9 percent in 1976 to 72.2 percent in 1977. The average for mockernut hickory ($N = 17$ trees) was 42.2 percent, ranging from 17.6 percent in 1974 and 1976 to 70.6 percent in 1972.

For the 6-year samples, 1974 and 1976 were obviously poor seed years for hickory when only 5 of 44 sampled trees produced sound seed. In contrast, 1970 and 1977 were good seed years, when 27 of 44 produced sound seed. In 1973 and 1975, 20 of 44 trees produced seed. Thus, in 6 years, 2 years were poor seed years, 2 were average, and 2 were good production years. In subsequent reports we will examine some of the factors affecting seed production.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

During the spring of 1978, 50 groups totaling 333 people made reservations and visited the prairie chicken booming grounds in Jasper County. We started the season for visitation by the public on 25 March and terminated the season on 23 April, for a total of 30 mornings.

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Requests from approximately 15 groups totaling 50 or 60 people had to be refused because of (1) extremely muddy field conditions that delayed use of our large wooden blinds, (2) nearly impassable public roads in the Bogota area, and (3) limitations in the number (20) of people that can be safely accommodated each morning without jeopardizing breeding success of prairie chickens.

Students and staff from 14 educational institutions, including Earlham College of Indiana, Miami University of Ohio, Southern Illinois University, Fairview Grade School, College of DuPage, Indiana University, Southeastern Illinois College, Greenville College, McKendree College, Belleville Area College, John Marshall High School of Indianapolis, Wheaton College, University of Illinois, and University of Cambridge in England represented 63 percent of the total number of visitors. Five Audubon or other ornithological societies supplied 14 percent. Various other groups, including personnel of the Department of Conservation and Illinois Natural History Survey made up 23 percent of the total.

Illinois supplied 50 percent of the visitors, Indiana 26 percent, Ohio 14 percent, and lesser numbers came from Kentucky, Tennessee, Pennsylvania, Missouri, New Jersey, and England. Thus, prairie chickens in Illinois continue to provide an unparalleled outdoor classroom for a broad, though limited, segment of the public. As in the previous springs, visitors aided the research project by recording their observations during 26 mornings.

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NATURAL HISTORY SURVEY

AUG 8 1978

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Helen C. Schultz, Editors

Urbana, Illinois

July, 1978

Vol. 21, No. 7

Manipulation of Pheasant Habitat

R. E. Warner

The first Rural Mail Carriers Census (RMCC) in Illinois was conducted over 5 consecutive days in April 1958 and has subsequently been repeated at 5-year intervals. Preliminary findings of the 1978 RMCC of the 74 northern counties of the state are now tabulated.

Eighty-eight percent of the 1,178 census cards mailed to rural letter carriers in 1978 were returned and usable; 89 percent were usable in 1973. A total of 366,005 miles were tallied on the RMCC this year--approximately 15,000 miles more than in the previous count. The number of pheasants observed per 100 miles of driving averaged 0.8 rangewide in 1978, compared with 4.9 in 1973, 5.5 in 1968, 9.9 in 1963, and 7.6 in 1958. Thus, the number of pheasants recorded by rural letter carriers in 1978 represents a decline of 83 percent over the 5-year period.

The 15 counties with the greatest relative abundance of pheasants are listed in Table 1. Counties that were among the top 15 in 1973 but were not on this list in 1978 include Macon, McLean, Iroquois, Moultrie, DeWitt, Kankakee, Vermilion, Champaign, Piatt, and Douglas. These counties, predominantly in east-central Illinois, rank 16, 21, 25, 29, 30, 33, 34, 39, 43, and 45, respectively, according to the 1978 RMCC. The northernmost two tiers of counties, broadly classified as a mixed livestock and dairy region, presently rank among the highest with respect to numbers of pheasants counted--a position that has been held in recent decades by the east-central cash grain belt. Declines in numbers of pheasants, observed over the past 5 years, were evident for all of the counties listed in Table 1.

The two factors that have most noticeably contributed to the depletion of populations of pheasants from 1973 to 1978 have been the continued expansion of row crop farming, resulting in less prime habitat for reproduction, and severe winter weather, particularly where protective cover is scarce. The RMCC indicated declines in numbers of pheasants of 80 to 96 percent since 1973 in Champaign, Ford, McLean, and Iroquois counties. Declines of this magnitude have been directly attributed to severe winter storms in 1976-77 and 1977-78 on intensively monitored areas in these counties (MWRL 21(6):1). This evidence, in conjunction with the fact that ringnecks presently appear in greatest numbers where protective winter cover is most abundant (in the northern tier of counties), suggests that the dramatic decline since 1973 is largely the result of severe storms during the past two winters.

THE UNIVERSITY OF CHICAGO

DEPARTMENT OF CHEMISTRY

RESEARCH REPORT NO. 1000

THE UNIVERSITY OF CHICAGO

CHICAGO, ILLINOIS

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Under our present condition of low pheasant numbers, some may question the legitimacy of a pheasant season this fall. With this consideration in mind, the continuing investigations of factors affecting pheasant abundance on several areas in east-central Illinois, where declines in populations of pheasants have been most dramatic, are enlightening. After the 1977-78 hunting season, winter sex ratio counts indicated that 1 in 3 pheasants afield on these areas were cocks. The male ringneck can successfully mate with at least 8-10 hens. Although pheasant densities were low on these areas of investigation last May, we found normal harem formation during the spring counts. Furthermore, nest studies conducted in east-central Illinois this summer show a typically high rate of fertile eggs. Thus, breeding has been successful in 1978.

Another question that may arise concerns the illegal kill of hens. Our data (MWRL 21(4):1-2) do not indicate that this illegal kill has increased with the decline in cock pheasants. In fact, the illegal hen kill has declined on the study areas in recent years as hunter pressure has decreased. In 1977-78, the illegal hen kill in Illinois was probably less than 8 percent.

Our nest studies this summer have shown some encouraging signs of recovery by populations of pheasants. The clutch size of nests in some areas has been greater than average. In addition, the percentage of nests that have hatched has been substantially greater than normal. Although we expect our brood counts to reflect the storm-related losses that have occurred over the past two winters, we believe that the strong reproductive capability of the ringneck will enable it to increase in numbers over the next few years, depending on the habitat available and favorable weather. The future harvest of pheasants in Illinois under the current restraints of bag limits and season length will not impinge upon this recovery. Curtailment of hunting can have no significant effect on increasing the abundance of a species so clearly limited by severe winter weather and lack of secure habitat.

Table 1. The 15 counties with the greatest relative abundance of pheasants according to the 1978 RMCC.

	County Rank		Pheasants per 100 Miles		Percent Change	
	1973 ¹	1978	1973	1978	1968 to 1973	1973 to 1978
Mason	12	1	10.1	6.26	+ 58	- 38
Winnebago	25	2	3.9	2.42	+290	- 38
Carroll	20	3	5.4	2.41	+170	- 55
Lee	21	4	4.9	2.18	+ 75	- 56
Stephenson	37	5	2.2	2.09	+144	- 5
Kendall	18	6	7.4	2.08	+ 48	- 72
Woodford	13	7	9.2	1.99	- 57	- 78
DeKalb	24	8	4.1	1.89	- 49	- 54

The first part of the report describes the current state of the world's oceans. It notes that the oceans are facing a variety of threats, including climate change, overfishing, and pollution. The report also discusses the importance of the oceans for the world's economy and for the well-being of the planet. The second part of the report provides a detailed analysis of the threats to the oceans. It examines the impact of climate change on the oceans, including rising sea levels, ocean acidification, and warming of the water. It also looks at the effects of overfishing and pollution on marine life. The third part of the report offers recommendations for how to protect the oceans. It calls for stronger international agreements, improved fisheries management, and increased efforts to reduce pollution. The report concludes by emphasizing the need for urgent action to protect the oceans for future generations.

The report also highlights the importance of the oceans for the world's economy. It notes that the oceans provide a source of food, energy, and raw materials. It also plays a key role in international trade and transportation. The report argues that protecting the oceans is essential for the long-term economic well-being of the world. It also discusses the role of the oceans in the global climate system. The oceans absorb a large amount of the heat and carbon dioxide that are released into the atmosphere. This helps to regulate the Earth's temperature and climate. The report warns that if the oceans are damaged, the global climate system could be disrupted, leading to catastrophic consequences for the planet.

The report also discusses the impact of climate change on the oceans. It notes that rising sea levels could threaten coastal communities and infrastructure. Ocean acidification could harm marine life, particularly coral reefs and shellfish. Warming of the water could lead to the bleaching of coral reefs and the displacement of marine species. The report also looks at the effects of overfishing and pollution on marine life. Overfishing has led to the depletion of many fish stocks, threatening the livelihoods of millions of people who depend on fishing for their income. Pollution, including plastic waste and chemical runoff, is also a major threat to marine life. The report calls for stronger international agreements to protect the oceans. It argues that the current legal framework is inadequate to address the scale of the threats facing the oceans. It calls for a new global treaty that would establish a legal framework for the sustainable use of the oceans. It also calls for improved fisheries management, including the implementation of catch limits and the establishment of marine reserves. Finally, the report calls for increased efforts to reduce pollution, including the elimination of single-use plastics and the improvement of industrial and agricultural practices.

Table 1: Summary of the threats to the oceans and the recommended actions to address them.

Threat	Impact	Recommended Action		Priority	Status
		Short-term	Long-term		
Climate Change	Rising sea levels, ocean acidification, warming of the water	Reduce greenhouse gas emissions, protect coastal infrastructure	Transition to renewable energy, implement carbon pricing	High	In progress
Overfishing	Depletion of fish stocks, threat to livelihoods	Implement catch limits, establish marine reserves	Strengthen fisheries management, promote sustainable fishing practices	High	Implemented
Pollution	Harm to marine life, degradation of water quality	Eliminate single-use plastics, improve industrial and agricultural practices	Strengthen international agreements, increase public awareness	High	In progress
Loss of Biodiversity	Disruption of marine ecosystems, loss of species	Establish marine reserves, protect critical habitats	Strengthen international agreements, increase public awareness	High	In progress
Disruption of Global Climate System	Disruption of the Earth's temperature and climate	Reduce greenhouse gas emissions, protect coastal infrastructure	Transition to renewable energy, implement carbon pricing	High	In progress
Threat to World Economy	Threat to food, energy, and raw materials; threat to international trade and transportation	Strengthen international agreements, improve fisheries management	Strengthen international agreements, increase public awareness	High	In progress
Threat to Future Generations	Threat to the well-being of the planet and the future of humanity	Strengthen international agreements, increase public awareness	Strengthen international agreements, increase public awareness	High	In progress

Will	34	9	2.5	1.87	- 7	- 25
Ogle	28	10	3.0	1.77	+ 50	- 41
McHenry	32	11	2.5	1.58	- 26	- 37
Livingston	2	12	25.2	1.50	- 24	- 94
Boone	27	13	3.1	1.39	+ 35	- 55
Logan	3	14	20.7	1.36	- 33	- 93
Ford	1	15	30.2	1.28	+ 3	- 96

¹The 1973 findings were published by Ronald F. Labisky in INHS Biological Notes No. 94, 1975.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

There are many factors that affect tree seed production, including climate, age of tree, and inheritance (some trees never bear much seed).

For 6 years we sampled seed production levels for forest-grown shagbark, mockernut, and pignut hickories. We found that seed production was variable among years, species, and individual trees (MWRL 21(6):2).

We examined the effects of growth rate (using most recent 10-year radial growth), dbh (diameter at breast height), crown surface area, and age on seed production for our sampled trees. We used simple linear correlation, the dependent variable being the average number of sound seed produced by each tree over the 6-year period.

We found that only two variables, dbh and crown surface area, were significantly correlated ($P < 0.05$) with seed production. We were somewhat surprised at the low correlation of seed production with age. We attribute the low correlation to the poor relationship between dbh and age in our sampled trees. Hickories are known for their slow growth and are frequently suppressed by competing trees. When released from this competition, however, hickories usually increase their growth rate. This pattern was apparent in our sampled trees, based on the variable growth patterns shown by core samples. Thus, some trees of 8 to 10 inches dbh were 80-90 years old and others of the same dbh were only 35-50 years old.

The amount of crown surface area reflects the degree of crown competition between adjacent trees. In general, the larger the crown surface the more seed will be produced. This pattern held true for our hickories and seems to apply to most trees.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Arguments favoring restoration of native vegetation on prairie chicken sanctuaries in Illinois include the following: (1) It is axiomatic that prairie vegetation be emphasized for prairie chickens on soils that were originally developed by prairie vegetation. (2) At least the erodable portions of the sanctuaries that are not well suited for plowing, row cropping, and reseeding to redtop and timothy every 8-10 years should be seeded to permanent stands of native vegetation. (3) Established prairie sods resist weed invasion better than redtop, timothy, or brome. (4) Prairie vegetation is fire adapted and generally provides ample fuel for prescribed burning to retard succession by woody plants. (5) The native grasses, especially big and little bluestem and Indian grass, can be managed economically and ecologically for prairie chickens because of their high production of good-quality forage for hay or pasture after the nesting and early brood-rearing season. (6) Prairies are aesthetically pleasing. (7) Prairies are beneficial to other species of wildlife.

Arguments unfavorable to restoration of native vegetation on the sanctuaries are also numerous. Existing data on the use of native vegetation by prairie chickens are disappointing (MWRL 21(3):3). Lowest densities of nests and lowest nest success were found in native grasses at Bogota when compared with fields dominated by redtop, timothy, or brome. Because switch grass now dominates most stands of prairie vegetation on the sanctuaries, present emphasis is directed to establishment of big and little bluestem, Indian grass, and various prairie forbs. This spring, unfortunately, no nests or other signs of use by prairie chickens were found on approximately 20 acres of diversified native prairie (without switch grass) about 500 m from the Donnelley booming ground. However, use by cottontail rabbits, pheasants, quail, and other wildlife (including woodcock) remained high in this tract. The presence of about 11 acres of dense woods and brush between the booming ground and this prairie may be a deterrent to prairie chickens. High use by pheasants may also deter prairie chickens from using this tract. It is paradoxical that the introduced pheasant seems to favor the native grasses and the native prairie chicken seems to favor the introduced grasses. Pheasants may not necessarily prefer native grasses for nesting, but pheasants at Bogota show heavy use of prairie grasses for roosting, escape cover, and crowing. During the spring of 1978, all but 2 of 18 cock pheasants at Bogota crowded consistently in or near fields of prairie vegetation. Thus, this undesirable alien (see MWRL 19(2):3-4) may benefit from greater acreages of native grasses on the sanctuaries.

Tall, dense prairie grasses may afford nest predators such as skunks, opossums, raccoons, minks, and weasels greater protection from horned owls and other enemies than would redtop, timothy, or brome. Also, the tall native grasses on the sanctuaries are most frequently searched (illegally) for coyotes by hunters using various all-terrain vehicles. Cottontails, a principal food of coyotes, are invariably more numerous in native grasses; thus, prairie grasses may foster higher coyote populations than would redtop, timothy, or brome. However, higher coyote numbers may not mean increased predation on

prairie chickens and their nests. We cannot discount the possibility that the coyote is among the more desirable predators because of its pressure on other mammalian nest predators.

Seeding to native grasses and forbs presents another difficulty, especially if we are limited to local seed sources. The "purist" approach to prairie restoration necessitates either hand stripping or combining of seed from local prairies. The seed is fluffy and featherlike and must be broadcast by hand. Processing to allow seeding by special grass drills is possible for various prairie species but is expensive. The special drills used for seeding processed native grasses are also expensive, as is nonlocal native grass and forb seed. Thus, our present approach to prairie restoration is to "trickle" a native grass-forb mix (unprocessed, local source) from the tractor seat while pulling a disk, a seeder with redtop and timothy, and a roller--all in one operation. Similar approaches in the past, when combined with prescribed burning, have resulted in satisfactory stands of prairie vegetation within about 3 years.

Continued research is obviously essential to determine whether the merits of prairie restoration can outweigh the present disadvantages in our efforts to preserve prairie chickens.

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NATURAL HISTORY SURVEY
SEP 11 1978
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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

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Urbana, Illinois

August, 1978

Vol. 21, No. 8

Manipulation of Pheasant Habitat

R. E. Warner

Roadsides in the Ford County Management Unit (FCMU) seeded in 1968 were considered to be mature as of summer 1970. Each farmer cooperator agreed not to mow these roadsides before 1 August in subsequent years. Since 1970, the chronology of roadside mowing has been monitored to determine the extent of adherence to the delayed mowing agreement. This summer (1978) approximately 60 percent of the roadsides were unmowed as of 1 August. On the same date, 1970-77, the percentages of cooperator miles unmowed were 72, 81, 78, 89, 87, 63, 64, and 48, respectively. The experience of these years shows that even though a high level of support for the roadside program has been expressed by participants (MWRL 19(4):2), a tendency exists for some cooperators to mow early, if time is available. In 1977, when only 48 percent of the roadsides on the FCMU were unmowed, the Illinois Crop Reporting Service (CRS) records show that crop planting that year was one of the earliest on record. This summer, crop planting was delayed beyond normal because of rainy weather; presumably because of the late planting, early roadside mowing was not as extensive in 1978 as in 1977. An in-depth analysis of the correlation between planting phenology and chronology of roadside mowing on the FCMU will be presented after statistics on planting in 1978 become available from the CRS.

For the third year, seedings on previously graded roadsides scattered throughout Ford County were monitored for chronology of mowing. In 1978, 50 percent of these roadsides (177 miles) were unmowed through 1 August; 64 and 21 percent were unmowed in 1977 and 1976, respectively. Thus, in 1978 early mowing was somewhat more evident on the scattered roadside seedings (50 percent mowed prior to 1 August) than on the FCMU block seeding (40 percent mowed prior to 1 August).

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

Seed crops of selected shagbark, pignut, and mockernut hickories were sampled for 6 consecutive years, using 33-gallon drums as seed collectors. Seed yields were found to vary greatly among years, ranging from a low of 11.3 percent (5/44) of sampled trees producing sound seed in 1974 to a high of 61.3 percent (27/44) producing sound seed in 1977.

One obvious and constant influence on tree growth and seed production is climate. Such factors as the amount of rainfall during the growing season and freezing temperatures during the spring when trees are blooming have been shown to influence seed yields in the oaks.

100

RESEARCH REPORT

ON THE EFFECTS OF

TEMPERATURE ON THE GROWTH OF

PLANTS IN A CONTROLLED ENVIRONMENT

BY

DR. J. H. SMITH

The purpose of this research was to determine the effect of temperature on the growth of plants in a controlled environment. The experiment was conducted in a growth chamber where the temperature was varied between 10°C and 30°C. The plants were grown in a nutrient solution and their growth was measured by the length of the stems and the number of leaves. The results showed that the growth of the plants was significantly affected by temperature. The plants grown at 20°C showed the highest growth rate, while the plants grown at 10°C and 30°C showed the lowest growth rates. The data is presented in the following table:

The data shows that the growth of the plants is significantly affected by temperature. The plants grown at 20°C showed the highest growth rate, while the plants grown at 10°C and 30°C showed the lowest growth rates. The data is presented in the following table:

TABLE 1. Growth of plants in a controlled environment at different temperatures.

Temperature (°C)	Stem Length (cm)	Number of Leaves
10	1.2	2
20	2.5	4
30	1.5	3

It is concluded that the growth of plants in a controlled environment is significantly affected by temperature. The plants grown at 20°C showed the highest growth rate, while the plants grown at 10°C and 30°C showed the lowest growth rates. The data is presented in the following table:

A stepwise multiple regression program was used to evaluate the influence of 27 weather parameters on production of hickory seed. Although the trends in seed production among species of hickories were similar for the 6 years measured, different weather factors accounted for most variability in each species.

We found no correlation between minimum temperatures during the spring flowering period and subsequent seed production. For precipitation, only the amount of rainfall in September was positively correlated ($P < 0.05$) with seed production the same fall. We are not sure whether this correlation has biological meaning because we used only sound seed production, not total seed production (sound, unsound, or aborted). September rainfall may affect the degree of insect predation on hickory seed and, thus, vary the amount of seed produced.

There was no one common weather factor that could account for the annual variation in hickory seed production in each species, partly because of the large variability among trees within each year, which made 6 years of data insufficient to reach any statistical conclusions about annual variation. In addition, individual weather variables may influence hickory production differently from year to year as other factors (internal and external, measurable and unmeasurable) change. Finally, we may not be selecting the correct variables.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

The search for nests on the Bogota Study Area in 1978 produced data that were invaluable from numerous standpoints. The sample of 55 prairie chicken nests found on 340 acres of sanctuaries was the highest number ever found relative to the spring population level (74 cocks). Although hatch success amounted to only 34.6 percent, the number of hatches (18) relative to the population level was also high (0.243 hatch per cock). In 1977, with essentially the same population level (75 cocks) as in 1978, 24 nests were found on 371 acres of the same sanctuaries, of which 13 (59.1 percent) hatched. In 1978, clutch size (12.5 eggs), fertile eggs per clutch (11.3), and hatched eggs per clutch (12.1) were all above average.

Two factors account for the relatively large number of prairie chicken nests found at Bogota this summer. First, late-winter counts showed an unusually high proportion of hens in the Bogota flock. The sex ratio appeared to be at least 50:50. Secondly, 80 percent of the breeding population was concentrated on 23 percent of the sanctuary acreage--where the search for nests was also concentrated.

Predation was the apparent cause of failure at 32 nest sites (60.4 percent) this year. Only one hen kill was evident among the destroyed nests, despite (1) the presence of an active den of red foxes within 1 mile of the main booming ground and (2) frequent observations of coyotes and raccoons in the Bogota area. Skunks were believed to be the primary nest predators in 1978, on the basis of (1) limited trapping, (2) hayfield mortalities, (3) road kills, and (4) other field observations. Minks were the main nest predators in 1977, and in previous years opossums were considered the primary predators on nests.

studies, but the present paper was used to evaluate the influence of seed vigor on the production of dry seed. Although the trends in seed vigor and seed production are similar for the 6 years assessed, the effect of seed vigor on seed production is not the same in each species.

It is important to note that the correlation between minimum temperature during the spring growing period and seed production is not the same for all species. For example, only the correlation between minimum temperature and seed production was significant ($P < 0.05$) with seed production in *Phaseolus vulgaris*. Further, the correlation between seed production and seed vigor was not significant in *Phaseolus vulgaris*, but it was significant in *Phaseolus coccineus*. It may be that the degree of insect damage to seed produced is different in the two species.

In the present study, the correlation between seed vigor and seed production was not significant in *Phaseolus vulgaris*, but it was significant in *Phaseolus coccineus*. This may be due to the fact that the correlation between seed vigor and seed production is not the same in all species. It may be that the degree of insect damage to seed produced is different in the two species.

The present study was conducted in the spring of 1998. The results of the study are presented in Table 1.

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Pheasant eggs were found in three prairie chicken nests this summer, two of which were destroyed by predators; one apparently hatched. Three other prairie chicken nests that contained intact but abandoned eggs (two involved clutches of 14 incubated eggs each) were in close proximity to crowing territories of pheasant cocks. A total of 13 pheasant nests were found on the sanctuaries at Bogota this summer, the largest number to date. Clutch size for seven incubated pheasant nests averaged 13.7 eggs and ranged from 10 to 18 eggs.

Thus, nest numbers and reproductive performance of prairie chickens and pheasants at Bogota in 1978 did not reflect the severity of the previous winter. However, the number of quail nests (5) found this year was the lowest since 1966. Only one ground nest of a mourning dove was found, also a record low. Meadowlarks, grasshopper sparrows, short-billed marsh wrens, dickcissels, field sparrows, and even red-winged blackbirds showed similar strong declines in numbers of nests. Cottontail rabbit nests (28), however, were the second highest on record. Small mammal (prairie vole and southern bog lemming) nests (2,077) were about average in 1978.

Thus, although skunks and apparently pheasants were direct contributors to the low nest success of prairie chickens this summer, that portion of the food base consisting of small birds was sharply reduced, thereby limiting prey opportunities for predators foraging on the sanctuaries. In previous years when nest success was low and the proportion of prairie chicken nests to nests of other ground nesters increased, nest success of prairie chickens also declined.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

NATURAL HISTORY SURVEY

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Manipulation of Pheasant Habitat

R. E. Warner

Land use on the Sibley Study Area (SSA) and Ford County Management Unit (FCMU) was monitored in 1978, as in previous years, by means of maps of field boundaries and cover types marked on aerial photographs. The percentage of land on the SSA planted in hay, small grains, and row crops has generally declined from 1962 to the present. Hay was planted on 1.6 percent (362 acres) of the land in 1978, 1.2 percent in 1977, 1.8 percent in 1976, and an average of 7.0 percent per year during 1962-69. Small grains were planted on 0.9 percent (197 acres) of the land in 1978, 1.4 percent in 1977, 2.0 percent in 1976, and an average of 8.3 percent per year during 1962-69. Row crops were planted on 85.9 percent of the SSA in 1978, 91.2 percent in 1977, 88.3 percent in 1976, and an average of 76.8 percent per year during 1962-69. This year, 2.6 percent of the fields on the SSA were left fallow in response to the current Federal Set-Aside-Acres Program.

Similar trends in land use were recorded for the FCMU. In 1978 only 0.3 percent (44 acres) of harvested hay was noted on the 20-square-mile area, a decline from the 2.2, 1.2, 1.1, 1.1, and 1.0 percent for 1973-77, respectively.

Trends in land use on the study areas indicate that attempts by the federal government to reduce the production of feed grains in 1978 have not contributed to increasing the amount of prime habitat available for the reproductive activities of the ringneck in east-central Illinois. The unused acres have been left fallow and not planted in cover preferred by pheasants (oats and alfalfa).

Pheasant nest studies were continued on the FCMU in 1978 for the sixth consecutive year. Densities of hatched nests in managed roadside vegetation averaged 0.12 per acre in 1978, compared with 1.30, 1.23, 0.27, 0.48, and 0.17 per acre in 1973-77, respectively. An estimated average of 1.3 nests per square mile hatched in non-row-crop cover on the FCMU in 1978; an average of 26.3, 16.5, 8.0, 8.0, and 2.2 hatched nests per section were estimated for 1973-77, respectively. In 1978, approximately 69 percent of all successful nesting attempts by pheasants occurred in roadsides. Over the 6-year period in which searches for nests on the FCMU have been conducted, 50 percent of all hatched nests were found in managed roadside vegetation.

The third summer of nest searches has been completed on 90 0.25-mile plots (totalling 57.5 acres) that were selected from the Ford County Graded Roadsides (FCGR). These roadsides are located in 9 different townships and

were seeded in 1972, 1974, and 1975 after the roadsides had been graded by township road commissioners following road bed improvements. An average of 0.05 hatched nest per acre was determined for the FCGR in 1978, compared with 0.12 in 1977 and 0.17 in 1976. Over the past 3 years, twice as many hatched nests have been found in roadsides on the block management area (FCMU) as in scattered seedings (FCGR). Nest densities on roadsides generally reflect the spring densities of breeding hens.

Next month's newsletter will consider reproductive success and the relative abundance of pheasant broods on study areas in east-central Illinois.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

Fox squirrel populations tend toward equilibrium in numbers from year-to-year, that is, densities may temporarily increase in late spring and in the fall, but the late winter densities are about the same from year-to-year. This mean density is a product of the available food and shelter interacting with an intrinsic social behavior that is inherent in each species.

Equilibrium density tends to increase as the habitat improves. As forests age and mast supplies and shelter sites increase, the survival prospects are improved for additional squirrels that are added to the population--either squirrels born on the area or those dispersing into the habitat.

Short term year-to-year changes do occur, usually the result of climatic effects (frosts, hard winters), food shortages (mast failures), or excessive predation (over-hunting in small woodlots). The subadult squirrels, who are usually subordinate members of the population, are usually most affected by these factors, probably because they cannot utilize the remaining food and shelters usurped by the dominant adult squirrels.

If fluctuations in density are upward, above equilibrium level, then dispersal rates for squirrels less than 1-year old increase, fecundity rates decline, and mortality increases. This occurred in southeast Ohio in 1966 and in North Carolina in 1962. If populations fall below the equilibrium level, fecundity improves, fewer young disperse, and the population rises to equilibrium again. There is no evidence of a long term predictable cycle in fox or gray squirrel abundance in the midwest.

What does this discussion have to do with fox squirrel management in Illinois? We wish to emphasize two points that must be considered in any management program: (1) There is no substitute for old-growth timber as squirrel habitat. Population studies of the occupied ranges of gray and fox squirrels have consistently shown squirrel densities to be 2-3 times as high in old-growth forests as in second-growth stands. (2) There is an equilibrium density in all habitats that cannot be surpassed because of social factors within each population. At least for gray squirrels, the addition of supplemental food or additional shelter will often lessen social pressures and increase populations. The evidence for fox squirrels is not so clearcut, and social behavior may be the principal roadblock to achieving higher densities through habitat management.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Measurements of vegetative structure (height and density) on sanctuary grasslands (MWRL 19:10 and 21:2) were taken again this past spring. Unfortunately, prolonged heavy snow cover prevented taking such measurements before the last week of March. To avoid disturbance of nesting prairie chickens, we do not sample the nest cover after the first week of April. Therefore, we only had time to sample those fields on the Yeatter sanctuary.

In 1978, cover in fields containing more than one prairie chicken nest had a lower mean maximum height (MMH) than either fields with one nest or fields with no nests. In 1976 and 1977, fields with more than one nest had a higher cover MMH than fields with one or no nests (MWRL 21:2). However, as in previous years, fields with more than one nest had a higher density (16.3 percent) than fields with only one nest (15.4 percent) or no nests (12.5 percent).

Observations this year indicate that density of vegetation is more important than height in determining placement of nests by prairie chickens. Normally, height and density of grasses are directly related. However, the heavy snow cover may have flattened the preferred grass cover thus both reducing its height and increasing its density at lower heights. Of the 15 nests found on the Yeatter sanctuary in 1978, 14 were in undisturbed cover. Undisturbed cover, while providing greater height and density, is more apt to lodge as a result of snow than cover that has been mowed.

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Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

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Manipulation of Pheasant Habitat

R. E. Warner

In 1978, 8 of the 12 pheasant nests (67%) found in roadside vegetation on the Ford County Management Unit (FCMU) and Ford County Graded Roadsides (FCGR) hatched. This high proportion of hatched nests (approximately two-thirds compared with the typical one-third that hatch) is an encouraging sign of recovery by pheasants in Illinois from the declines in populations suffered during the last two severe winters (MWRL 21(7):2).

Although the success of nesting by pheasants was above average this year, the August 1978 census of broods nonetheless reflects the sparse breeding population that was counted on the study areas last May (MWRL 21(6):1). In August personnel from the Natural History Survey and Department of Conservation cooperated in censusing broods on five areas: the Sibley Study Area (SSA, reference area) and four block roadside seedings--the FCMU, Anchor, Harwood, and Prairie Green (Anchor, Harwood, and Prairie Green were seeded within the last 2 years). Broods counted in August 1978 averaged 1.0, 0.6, 2.0, 4.3, and 2.5 per 100 miles of driving on the SSA, FCMU, Anchor, Harwood, and Prairie Green, respectively; in 1977, 2.3, 26.9, 5.2, 7.0, and 5.7 broods were counted on these respective areas, compared with 10.3, 29.4, 17.7, 7.5, and 19.0 on these areas in 1976. The average decline in broods observed on all areas, 1978 from 1977, was approximately 78 percent.

The decline in broods observed this year is congruent with the decline in the spring breeding population on all areas except the FCMU (MWRL 21(6):1). On that area the number of broods appears lower than expected on the basis of the spring count and the unusually high success of nesting. Cock call and visual counts made in May 1978 on the SSA and FCMU suggest that more pheasants existed on the FCMU than on the SSA; yet, only 0.6 brood was counted per 100 miles on the FCMU in 1978 compared with 1.0 on the SSA. This anomaly contributes to evidence suggesting that there may be a difference in the behavior and observability of broods along roadsides in managed and unmanaged areas. Since 1970 (when roadside vegetation became mature on the FCMU) the correlation between the spring breeding population censused and subsequent August brood counts has been greater ($r = 0.46$) on the SSA than on the FCMU ($r = 0.26$).

Further, the data from this 9-year period indicate that the number of broods observed along roadsides on the FCMU may be influenced by the amount of nesting that occurs in roadside vegetation. On the basis of winter and spring censuses, fewer-than-expected broods have generally been observed on

Department of Health and Human Services, Washington, D.C.

Dr. C. Anderson and Dr. J. J. Anderson

October 1967

Division of Research and Statistics

In 1967, the Department of Health and Human Services, Washington, D.C., conducted a study of the health status of the population of the United States. This study was part of a larger study of the health status of the population of the United States, which was conducted by the Department of Health and Human Services, Washington, D.C., in 1967.

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roadside counts of the FCMU in years when a large proportion of all nesting (greater than 50%) in the area occurs in roadsides. The fact that 69 percent of all successful nests on the FCMU in 1978 were found in roadsides (MWRL 22(9):1) and that brood counts were lower than expected, appears to be in keeping with the findings of previous years. This topic warrants further study under conditions of stable populations, which have not existed on the FCMU in recent years. These findings may have implications for the evaluation of roadsides as potential brood habitat.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

Nest boxes should provide fox squirrels with a warmer, more-protected nest site than a nest constructed of leaves or twigs. If this theory is correct, squirrels wintering in nest boxes should be in relatively better physical condition than those wintering in leaf nests.

In order to test this theory, we compared the percentage carcass fat (on a dry-weight basis) for male fox squirrels collected from nest boxes with male fox squirrels from leaf nests in late February 1978 on our Vermilion County, Illinois, study areas.

We found no significant difference in percentage carcass fat between males from nest boxes and those from leaf nests. In fact, males from leaf nests averaged slightly fatter (16.8 percent, $N = 10$) than males from nest boxes (15.2 percent, $N = 20$). Thus, nest boxes do not appear to provide fox squirrels with more protection from winter weather than a well-constructed leaf nest. The winter of 1977-78 should have provided a stern test of the suitability of shelter for squirrels, as temperatures were far below normal and snowfall much above normal for a large portion of the winter. In late February, when we collected squirrels, there was 1-2 feet of snow present throughout the Vermilion County study areas.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

A cash bid procedure was used from 1975 through 1978 to manage the state-owned prairie chicken sanctuaries, which include 567 acres or 35 percent of the total sanctuary acreage (1,641 acres). Because of the specialized nature of grassland management on the sanctuaries, interest in bidding for leases by local farmers is minimal. Thus, leases were simply renewed on 29 September for the crop years of 1979-80, with four of the five previous lessees. One previous lessee declined renewal of his lease, but a replacement was found. Cropping schedules and estimates for determining fair fees of percentage shares to the state for the next 2 years were determined by the Prairie Chicken project. The Division of Property Management, Department of Conservation (DOC), then handled the typing, signing, and mailing of the new leases.

Lessees were given the option of paying the state either (1) a fee on the basis of the acreage cropped, hayed, grazed, or harvested for grass seed or (2) a cash percentage of the various crops involved. One lessee chose to pay a fee for each acre farmed; the other four lessees chose to pay a percentage of the grass seed and grain crops. An additional option added to the new leases specifies that lessees may substitute limestone applications for sums due the State. Approaching the need for limestone in this manner saves time and expense for both this project and DOC, since requisitions, selection of bidders (who in one instance was located 45 miles away from the sanctuaries), invoice vouchers, and correspondence with limestone dealers are all eliminated.

Harvesting of redtop and timothy seed, hay mowing, and mowing for weed and brush control continue to be the primary operations used to manage nest cover on the sanctuaries. Relatively small acreages of soybeans or corn, wheat or oats, and red clover are permitted for the purpose of renovating old sods and providing booming grounds. Additional operations required by lessees include seeding redtop and red clover and fertilizing any meadows harvested for hay.

Although prairie farmland in Jasper and Marion counties is commonly cash renting for \$100.00 per acre, cash bids on the state-owned sanctuaries ranged from \$0.13 to \$11.00 per acre for the crop years of 1975-76 and from \$0.50 to \$2.50 per acre for the crop years of 1977-78. For the crop years of 1979-80, the one cash fee amounted to \$3.00 per acre and the four percentage shares ranged from 5 to 10 percent of grass seed or grain crops. These fees or shares to the state are necessarily low--mainly because of (1) the uncertainties of redtop seed farming; (2) the mowing, fertilizing, or other expenses incurred by lessees; and (3) because lessees are assessed for taxes on harvested acres. Land taxes averaged about \$8.00 per acre in Jasper County this year. Thus, while the fees or shares should be fair to the state, they should be relatively low for these reasons. Also, the primary objective of sharecropping should be to accomplish as many of the necessary management operations as possible in order to reduce (1) the man hours spent by project personnel on management and (2) additional costs to the Division of Wildlife Resources.

Urbana, Illinois

November, 1978

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Manipulation of Pheasant Habitat

R. E. Warner

A moderate number of pheasant hunters (somewhat more than were observed in 1977) were afield on the Sibley Study Area (SSA) and Ford County Management Unit (FCMU) during the opening weekend (11-12 November 1978) of the upland game season. Conditions for hunting were generally favorable: weather was mild and dry, corn and soybean harvest was completed, but fall plowing was extensive. In recent years when plowing has been extensive, birds have been concentrated in residual and permanent cover for the first few hours of hunting and are then dispersed by hunter activity to plowed fields where they are relatively inaccessible for the remainder of opening weekend.

Hunters indicated that their efforts afield were more successful on both areas this year than in 1977. Man-hours expended to bag a rooster on the SSA averaged 18.4 in 1978 and 35.0 in 1977; on the FCMU, 7.9 in 1978 and 11.6 in 1977 (Table 1). Since 1974 an average of over 2.5 times as many man-hours was tallied per cock harvested on the SSA as on the FCMU.

Improved hunting on the areas this fall appears to be primarily related to the rate of recruitment of young into the fall pheasant population rather than to differences from previous years in weather, status of crop harvest, or hunter efficiency. Eighty-four percent of the cocks that were aged on opening weekend were juveniles, which indicates an above-average number of young in the fall population (Table 1). Although the density of nests, broods, and breeding hens observed on these areas was lower in 1978 than in 1977 (MWRL 21(10):1), the rate of recruitment of juveniles into the fall population per breeding hen may have been enhanced by an unusually high proportion of nests hatching, slightly greater clutch size, and improved survival of juveniles.

The improvement in hunter success on the study areas during opening weekend--if it is the result of a higher rate of recruitment of juveniles into the fall population per breeding hen--may be an encouraging sign of pheasant recovery from the heavy losses sustained during the past two severe winters (MWRL 21(6):1).

1. The first of these is the fact that the majority of the population of the United States is now living in urban areas. This is a result of the process of urbanization, which has been going on since the beginning of the 20th century. The process of urbanization is the movement of people from rural areas to urban areas. This movement is caused by a number of factors, including the search for better living conditions, the desire for education, and the need for employment. The result of this process is that the majority of the population now lives in urban areas, which are characterized by high population density, a high level of economic activity, and a high level of social organization.

Table 1. Success of pheasant hunters on the Sibley Study Area and Ford County Management Unit during opening weekend of upland game season, 1973-1978.

	1973	1974	1975	1976	1977	1978
Number of Parties Interviewed ¹	28	36	28	27	18	30
Number of Pheasants Harvested ¹	91	73	78	80	27	56
Percent of Birds Juvenile ¹	85	71	60	74	75	84
<u>Man-hours per Pheasant Harvested</u>						
Sibley Study Area	<u>1</u> 7.4	8.3	16.5	9.7	35.0	18.4
Ford County Management Unit	<u>1</u>	3.1	4.7	6.2	11.6	7.9

¹ Statistics for both study areas combined.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

It is axiomatic that nest boxes for fox squirrels, to be effective, must be placed in the physical environment the squirrels require for nest sites. As a part of our studies evaluating nest box use by fox squirrels, we collected data on the physical environment surrounding each of our nest boxes. Those data included a number of variables such as box height, tree species, number of escape trees, and direction of the entrance.

Twenty-seven such variables were used in a discriminant function analysis to determine use or non-use of a particular nest box. The discriminant function analysis selected three variables as being important in separating used versus non-used nest boxes. There was a positive relationship between box height and box use by fox squirrels, a negative relationship between the number of existing cavities in the nest box tree and squirrel use of a nest box, and a positive relationship between the number of abandoned leaf nests in the 30-meter quadrat surrounding the nest box and use of a nest box.

These data suggest that nest boxes should be placed as high in a tree as possible and should not be placed in a tree with an existing cavity. The positive relationship between nest box use and the number of abandoned leaf nests suggests that squirrels will abandon leaf nests for a nest box if possible.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

The sample of 55 prairie chicken nests found in a search of 340 acres on sanctuaries at Bogota in 1978 was the highest number ever found relative to the spring population (74 cocks). Unfortunately, hatch success amounted to only 34.6 percent.

The following table shows the results of the analysis of the data for the year 1960.

Year	1960	1961	1962	1963	1964
1	10	15	20	25	30
2	12	18	22	28	32
3	14	20	24	30	34
4	16	22	26	32	36
5	18	24	28	34	38
6	20	26	30	36	40
7	22	28	32	38	42
8	24	30	34	40	44
9	26	32	36	42	46
10	28	34	38	44	48

Table 1. Results of the analysis of the data for the year 1960.

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In fields dominated by redtop in 1978, 23 nests were found in 100 acres. Densities averaged 2.3 total nests and 0.7 hatched nest per 10 acres; nest success averaged 35.0 percent. Since 1963, the 2,606 acres of redtop that have been searched on the sanctuaries at Bogota have yielded a total of 341 prairie chicken nests. Densities were 1.3 total nests and 0.7 hatched nest per 100 acres; nest success averaged 53.1 percent in redtop for the 16-year period.

In fields dominated by timothy, 11 nests were found in 47 acres; thus timothy yielded the same density of total nests (2.3 per 10 acres) as redtop, but hatch success amounted to only 10 percent in 1978. Since 1963, a total of 128 nests was found in 740 acres of timothy. Densities averaged 1.7 nests and 0.8 hatched nest per 10 acres, an average rate of success of 52.6 percent. Thus, overall, the data for redtop and timothy are nearly the same.

Fields dominated by brome have been most attractive to nesting prairie chickens; 53 nests were found in 212 acres since 1963. Densities were 2.5 nests and 1.2 hatches per 10 acres. Nest success has averaged 49.0 percent in brome.

Nest densities and success in prairie grass were the same in 1978 as in previous years. Since 1963, 42 nests were found in 395 acres of native grasses; densities averaged 1.1 nests and 0.4 hatched nest. Nest success was only 33.3 percent.

Mixtures of weedy grasses and forbs, a "catch-all" category in which a dominant species is not readily apparent, have been accepted by nesting hens to a similar degree as redtop but have shown only fair nest success (47.2 percent) since 1963. This cover category generally involves sods about 10 years old or older that are scheduled for plowing.

Legumes (mainly red clover)--in at least the 3rd year of growth, or 2nd-year small-grain stubble containing new grasses and legumes--have shown low densities but high nest success. In 1978, 4 of the 18 hatched nests found occurred in these cover categories; cover height was short, probably no more than about 15 cm, at the time most nests were initiated. These data demonstrate the wide latitude prairie chickens sometimes show in selecting nest sites.

Most disappointing are the results for the prairie grasses. As we have noted before (MWRL 21(7):4-5), continued research is obviously essential to determine whether the merits of prairie restoration can outweigh the present disadvantages in our efforts to preserve prairie chickens.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

December, 1978

Vol. 21, No. 12

Manipulation of Pheasant Habitat

R. E. Warner

There are approximately 2,500 acres of vegetation along four-lane (interstate) highways in the east-central counties. In terms of potential nest habitat, these acreages are important, especially since the Illinois Department of Transportation (DOT) has curtailed early mowing of interstate networks.

In order to facilitate a controlled evaluation of the potential of brome-alfalfa and fescue seedings for nesting along interstates, the DOT seeded two test areas in 1973. Brome-alfalfa was seeded on approximately 1 mile of roadside along the newly constructed FAI-55 near Odell, and fescue was seeded on a 1.2-mile stretch of roadside directly north of the brome-alfalfa seedings. These test seedings were expected to be established within 2 or 3 years, and in 1976 a nest study was initiated. However, the seedings had not become established by that year; sweet clover dominated the roadsides near Odell, and the vegetation along the 2.2-mile stretch was not representative of the prescribed seeding types. Searches in mid-June revealed four pheasant and eight songbird nests in the sweet clover on five 0.125-mile plots totaling 4.6 acres.

In 1977 the future of the Odell seedings as an evaluation site appeared more promising. Brome and alfalfa (particularly alfalfa) were dominant species along the southernmost mile of the 1973 seeding; mixed fescue plots (containing a mixture of bluegrass, fescue, clover, and redtop--in order of dominance) were established along the northern 1.2 mile. Mid-June and mid-July searches for nests were conducted in 1977 on four brome-alfalfa and six fescue plots totaling 6.0 acres. For each type of seeding, an equal number of plots (two brome-alfalfa and three fescue) were searched along northbound and southbound lanes. The northbound lane was closed to traffic in 1976 and 1977 except for construction vehicles. Traffic in the southbound lane was similarly restricted in 1976 but became heavy in 1977 when southbound vehicles from old I-55 were rerouted to this lane. Neither of the seeding types exhibited an overall difference in appearance or composition between the northbound or southbound lanes. No pheasant nests were found on the plots in 1977, presumably because of the sparse breeding population in Livingston County, which was documented by Department of Conservation biologists. Fifteen red-winged blackbird nests were found on brome-alfalfa plots and two on fescue plots. Two rabbit nests and a pair of adult meadowlarks and two fledglings were also noted on fescue plots. Thirteen of the 17 blackbird nests were found adjacent to the northbound lane used only for construction vehicles.

The Odell plots were again searched for nests in 1978. As in 1977, the breeding population of pheasants in the area was very low. Prior to the 1978 nesting season, the northbound lane was also opened to traffic; thus for the first time vehicular flow was similar along all plots searched. Nests located

THE UNIVERSITY OF CHICAGO

DEPARTMENT OF CHEMISTRY

RESEARCH REPORT NO. 100

BY J. H. HARRIS AND J. E. HARRIS

Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Chicago, Illinois, 1955

The following report was prepared under the supervision of Professor J. H. HARRIS, who is now at the University of California, San Diego, and who is now at the University of California, San Diego, and who is now at the University of California, San Diego.

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In 1978 included one pheasant (hatched on a brome-alfalfa plot), three songbird (two on brome-alfalfa plots), and four rabbit (all on mixed fescue plots).

Although the limited amount of data collected thus far prohibit tenable conclusions (this study will be continued in 1979), two noteworthy trends are apparent. First, all four rabbit nests located in 1977 and 1978 were in mixed fescue seedings; however, rabbit nests may be more observable in the mixed fescue plots than in the dense brome-alfalfa vegetation. Secondly, 13 of the 17 songbird nests located in 1977 were along the lane closed to traffic. In 1978 when there was both north and southbound traffic, only three songbird nests were located. As next month's newsletter will document, densities of songbird nests in other roadside seedings in 1978 were similar to previous years.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

Both gray and fox squirrels utilize tree cavities or leaf nests, or both, for protection from predators and inclement weather or as nurseries for their young. We have found that forests in northern Illinois that are occupied by gray squirrels contain an average of twice as many tree cavities as do forests devoid of gray squirrels. We have never found a forest with gray squirrels that had less than two good quality tree cavities per acre. We also found that female fox squirrels are more likely to keep preweaned young in a tree cavity instead of in a leaf nest or nest box.

Thus we feel that retention of good quality tree cavities (2- to 3-inch diameter entrance hole, 12-24 inches deep) is important for both gray and fox squirrels. To ensure that foresters and wildlife managers retain trees that readily form cavities at a relatively early age, it is necessary to identify those species most likely to form suitable nest sites.

As a first step, we counted all the trees >5.0 inches dbh with and without tree cavities on 63.5 acres of hardwood forest. Tree age varied between 50 and 100 years depending on the site. We found that three species--sugar maple, basswood, and beech--all contained significantly more cavities than would be expected on the basis of total tree count, and that white and black oaks and the hickories contained significantly fewer cavities than expected on the basis of their abundance.

In Illinois, sugar maple, basswood, and beech are found growing on moist, fertile soils usually on lower slopes and coves. Because they are not particularly valuable for lumber products, foresters may remove them in favor of the more valuable oaks, tuliptree, and black walnut. If one or more of these species are present in a stand to be logged, we recommend retention of two or three trees per acre in the course of logging or timber stand improvement. At present squirrel densities in Illinois (1-2 per acre), this density of trees with cavities would provide most squirrels and other cavity-nesting wildlife access to a tree cavity.

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Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Clutch size, the number of fertile eggs per clutch, the number of hatched eggs per clutch, and the percentage fertility and percentage hatchability of eggs are basic parameters with which to measure the reproductive potential of prairie chickens. Although these data are limited for the years 1963-67, our nest study has provided some insight on these aspects for 16 consecutive years at Bogota. Only those clutches for which counts were considered complete were used in the following analysis.

During the 16 years, 1963-78, the sizes of 232 incubated clutches of prairie chicken eggs at Bogota ranged from 5 to 25 eggs. The mean number of eggs per incubated clutch ranged from 10.5 in 1971 to 13.1 in 1970 and averaged 11.8 for the 16 years. Despite these fluctuations, the overall mean clutch size was stable for the 16-year period.

The mean number of fertile eggs for 192 incubated clutches ranged from 9.6 in 1974 to 12.4 in 1970 and averaged 11.1 for the 16 years. As was the case for clutch size, the number of fertile eggs per clutch appeared to be stable. The fertility of 2,259 prairie chicken eggs ranged from 91.0 percent in 1969 to 97.0 percent in 1965 and averaged 94.8 percent for the 16 years. The percentage of fertile eggs also appeared stable over the years.

However, the data for the number of hatched eggs per clutch and percentage hatchability reveal what may be cause for concern. The mean number of hatched eggs per clutch for 212 clutches ranged from 8.9 in 1974 to 11.7 in 1970 and averaged 10.5 for the 16 years. The hatchability of 2,497 prairie chicken eggs ranged from only 82.3 percent in 1974 and 82.6 percent in 1978 to 100.0 percent in 1965. Graphic presentation of both the mean number of hatched eggs and percentage hatchability reveals definite downward trends over the 16-year period at Bogota.

We are unable to explain why hatchability and the number of hatched eggs per clutch are declining. cursory examination of the data seems to rule out such factors as population density, nest density, and weather. Pesticide contamination may merit investigation. However, our data on quail and pheasant nests at Bogota show no similar trends in lower hatchability. Harassment and competition by pheasants and disturbance by observers in blinds merit consideration, although the maintenance of normal fertility levels indicates that the problem does not occur on the booming grounds. One might speculate that harassment by pheasants is adversely affecting the attentiveness of incubating hen prairie chickens and thereby lowering hatchability. Also, the high levels of predation during the last 6 years with higher concomitant renesting could conceivably result in lowered hatchability. Worst of all, the trend in lower hatchability may be a reflection of a loss of genetic variation in the population of prairie chickens at Bogota; we hope it is not.

THE EFFECT OF TEMPERATURE ON THE DEVELOPMENT OF THE EGG

The purpose of this experiment was to determine the effect of temperature on the development of the egg. The experiment was conducted by incubating eggs at different temperatures and recording the time taken for the embryo to develop.

The results of the experiment showed that the time taken for the embryo to develop was significantly shorter at higher temperatures. This suggests that the rate of development is directly proportional to the temperature.

It was also found that the time taken for the embryo to develop was significantly longer at lower temperatures. This suggests that the rate of development is inversely proportional to the temperature.

The results of this experiment are consistent with the theory that the rate of development is directly proportional to the temperature. This is because the rate of chemical reactions, which are responsible for the development of the embryo, increases with temperature.

The results of this experiment also show that the time taken for the embryo to develop is significantly longer at lower temperatures. This is because the rate of chemical reactions, which are responsible for the development of the embryo, decreases with temperature.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R.

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

January, 1979

Vol. 22, No. 1

Manipulation of Pheasant Habitat

R. E. Warner

Since 1976 selected quarter-mile plots of roadsides seeded on the Ford County Management Unit (FCMU) and Ford County Graded Roadsides (FCGR) have been searched in June and July for songbird nests and pheasant nests. In 1978, 51 songbird nests were found on 67 plots (42.4 acres) on the FCMU; this density of 1.2 nests per acre is similar to densities of 1.2 and 1.3 nests per acre in 1976 and 1977, respectively.

Searches of 90 FCGR plots (57.7 acres) in 1978 indicated an average of 1.7 nests per acre; searches in 1976 and 1977 indicated 1.0 and 2.2 nests per acre, respectively.

Over 400 nests of songbirds have been found on brome-alfalfa roadsides over the past 3 years; 95 percent of these were nests of red-winged blackbirds. Although these searches have documented that songbirds nest in seeded roadsides, important questions have not been answered regarding nest and fledgling success, territorial behavior, and the influence of vegetational composition on the diversity of species nesting in roadside seedings.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

As reported in last month's research letter, beech, basswood, and sugar maple are the best providers of cavities for squirrel nesting and escape cover. This analysis, however, did not consider the importance of tree size on cavity formation. Large, slow-growing trees apparently are prone to cavity formation because wounds--for example, the loss of a limb--may not heal rapidly enough to prevent rotting and formation of a cavity.

Figure 1 shows the frequency of size classes in trees with cavities and in total trees on 63.5 acres of hardwood forest. Although trees >12 inches dbh make up only a small percentage of the total trees, a majority of cavity-forming trees are found in this range. Few trees of any species less than 12 inches dbh contained cavities. We recommend, therefore, that size as well as species be considered in the retention of potential cavity-forming trees. For more immediate results, these trees should be at least 12 inches dbh. Because timber harvesters select large trees (>14 inches dbh), a conscientious effort will have to be made to save the cavity-forming trees, which are an important component of squirrels habitat.

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Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

In MWRL 21(11):2-3, it was shown that in grasslands dominated by redtop, timothy, brome, or prairie grass (mainly switchgrass), nest success was 53.1, 52.6, 49.0, and 33.3 percent, respectively. From the standpoint of hatched nests per 10 acres, the ranking was brome (1.2), timothy (0.8), redtop (0.7), and prairie grass (0.4).

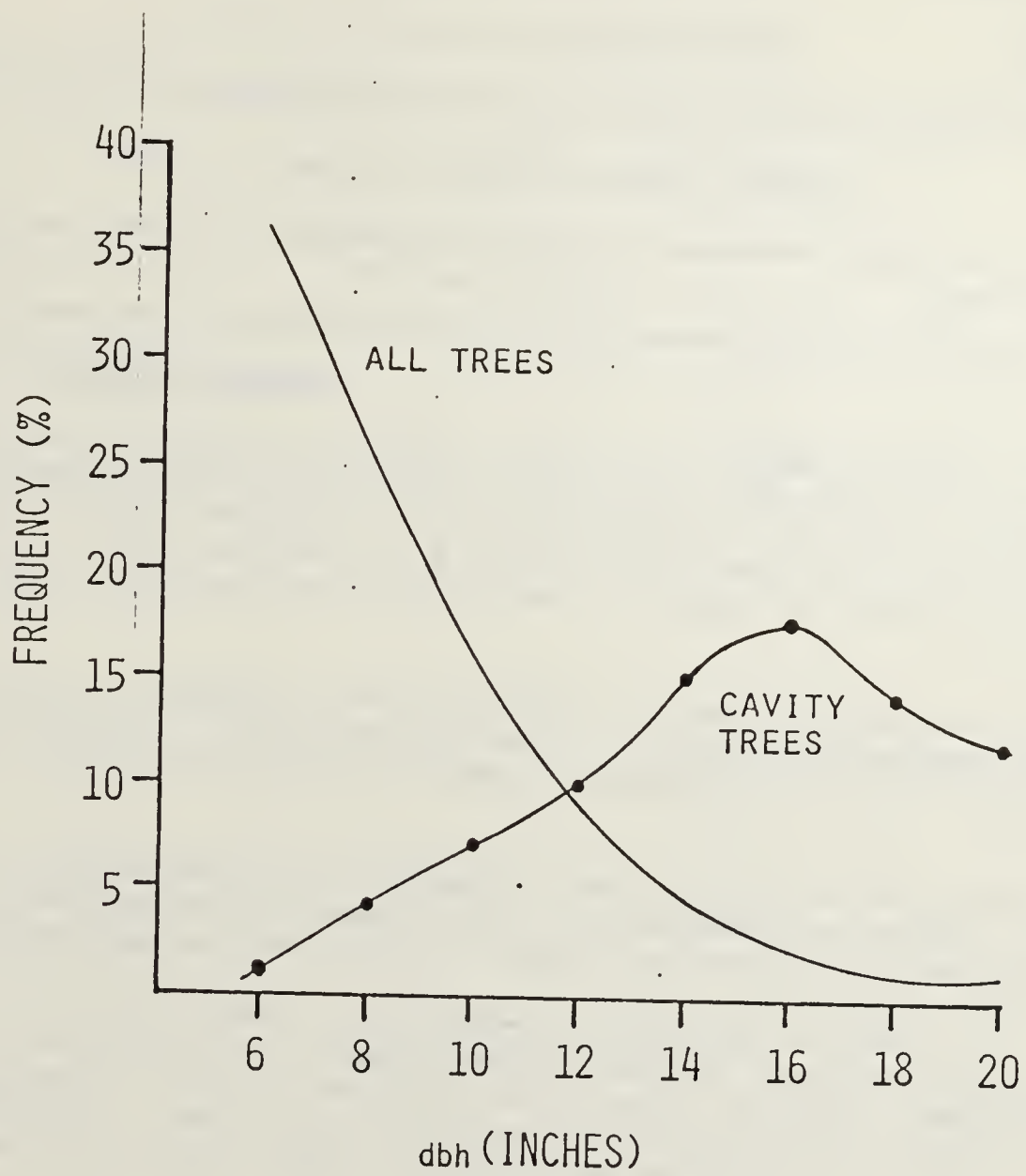
An evaluation of grasses used for nesting by prairie chickens should consider more than the dominant species in a field. The predominant cover at a nest site may be different than the field dominant. For 531 prairie chicken nests found in a redtop, timothy, brome, or prairie grass field, the cover at the nest site was composed of 100 percent of the field dominant in an average of only 10.4 percent of the nests. The cover at 54.8 percent of the nests was primarily the field dominant mixed with other species. One-third of the nests were concealed by cover dominated by species other than the field dominant.

The cover at nest sites was composed of either 100 percent of the field dominant or primarily the field dominant at 79.5 percent of 39 nests in brome fields, 77.2 percent of 136 nests in timothy fields, 63.7 percent of 44 nests in prairie grass fields, and 58.4 percent of 312 nests in redtop fields. Thus, redtop showed the lowest fidelity, i.e. plant species other than redtop predominated at 41.6 percent of the nests found in redtop fields. Other plants most frequently associated with nests in redtop fields included timothy, dewberry, yarrow, goldenrod, horse nettle, and to a lesser extent, 34 other plant species. Brome showed the highest fidelity as all but 15.4 percent of the nests in brome fields were concealed by brome.

The conclusion to be drawn from these data is that although nest success is high in redtop, prairie chicken hens have shown a greater preference for diversity in redtop fields than in fields dominated by timothy, brome, or prairie grasses. Thus, we include timothy and legumes (red clover, alsike clover, and Korean lespedeza) in new redtop seedings, but we attempt to have redtop sufficiently dominant in the resulting sod to make seed harvesting feasible. Further diversification with dewberries and weedy forbs occurs naturally as redtop sods age. Generally by the time redtop sods are about 10 years of age, plowing, cropping with soybeans, and reseeding are necessary.

Because brome has shown high densities of hatched nests, high fidelity, and good weed resistance with minimum maintenance, we are giving greater consideration to the use of brome on the sanctuaries. In fields where relatively permanent sods are desired because of erosion problems, a combination of prairie grass and brome seems prudent. Thus, we are including brome in new prairie seedings and making some attempts to add brome to fields with established prairie grasses by overseeding brome after a prescribed burn or by light disking and overseeding brome after haying.

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NATURAL HISTORY SURVEY

MONTHLY WILDLIFE RESEARCH LETTER

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Illinois Federal Aid Project W-66-R

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Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

February, 1979

Vol. 22, No. 2

Manipulation of Pheasant Habitat

R. E. Warner

A primary focus of this project has been to investigate the population ecology of pheasants relative to roadside management. Two goals of the Department of Conservation's (DOC) "Roadsides for Wildlife" program are (1) to locate roadside seedings so that pheasants and songbirds will nest there, and (2) to secure the long-term cooperation of participating farmers in delayed mowing of roadsides.

More information regarding farm cooperators will be acquired through three avenues of investigation. First, farmers on the Ford County Management Unit (FCMU) will be interviewed in order to identify characteristics of long-term cooperators.

Secondly, roadside mowing of seedings in block areas (similar to the FCMU), will be compared with mowing of seeded areas that are widely scattered. Hypothetically, neighboring cooperators will reinforce agreements to delay mowing.

Thirdly, a meaningful sample can be selected from the two types of cooperators: volunteers who have specifically requested that the DOC seed their roadsides, and farmers who have been solicited by the DOC to participate in roadside management. Monitoring of roadside mowing may indicate that volunteers delay mowing more consistently than solicited farm cooperators.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

Shelter is a necessity for any animal. Fox squirrels commonly use two types of shelter: tree cavities, which were discussed in previous newsletters, and leaf nests, which will be the subject of the next several newsletters. Leaf nests were counted during seven autumns (1971-77) and during five springs (1974-78) on 47 ha of mixed-hardwood forest in east-central Illinois as part of a study of the influence of nest boxes on squirrel populations. We counted all leaf nests but considered them unusable by the squirrel if we could see through the center of the nest with binoculars.

Leaf nests on the study area were used exclusively by fox squirrels. None of the approximately 275 nests we poked in the spring of 1978 contained a gray squirrel, even though this species made up around 10 percent of the total population. Gray squirrels are known to build leaf nests in some areas but apparently prefer tree cavities when they are available.

1. Identification of the problem

2. Statement of the problem

A primary factor in the development of the problem is the lack of adequate data on the prevalence of the disease. This is due to the fact that the disease is often asymptomatic and is therefore not reported. The lack of data makes it difficult to estimate the true prevalence of the disease and to plan appropriate control measures.

The second factor is the lack of adequate resources for the control of the disease. This is due to the fact that the disease is often neglected and is therefore not given priority in the allocation of resources.

The third factor is the lack of adequate knowledge of the disease. This is due to the fact that the disease is often poorly understood and is therefore not given priority in the allocation of resources.

The fourth factor is the lack of adequate cooperation between the various agencies involved in the control of the disease. This is due to the fact that the disease is often neglected and is therefore not given priority in the allocation of resources.

3. Statement of the objectives of the study

The objectives of the study are to determine the prevalence of the disease, to determine the factors which influence the prevalence of the disease, and to determine the effectiveness of the control measures.

The study will be carried out in three phases. The first phase will be to determine the prevalence of the disease. The second phase will be to determine the factors which influence the prevalence of the disease. The third phase will be to determine the effectiveness of the control measures.

More leaf nests were found during fall ($\bar{X} = 319$) than during spring ($\bar{X} = 176$). However, a greater proportion of the spring leaf nests (61 percent) than fall leaf nests (46 percent) were considered usable. Apparently individual fox squirrels maintain fewer nests throughout the winter than they build during summer and fall.

It is possible that fox squirrels may not build leaf nests if abundant shelter is available. Because additional shelter in the form of nest boxes was present on part of the study area, we could compare the density of leaf nests on sites with and without nest boxes. T-tests revealed no significant differences between the density of leaf nests on the sites with and without nest boxes. Either nest boxes are less suitable than leaf nests as shelter for fox squirrels, or fox squirrels have an innate tendency to build leaf nests regardless of other shelter. Based on other research work, we believe the latter to be true.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Previous reports on the relationship between vegetative structure and nest density of prairie chickens (MWRL 21(2):3 and MWRL 21(9):3) indicated that nest density generally increases as height and density of the vegetation increase. However, this direct relationship apparently does not apply to nest success.

The technique used to describe vegetation structure (height and density) involves taking point samples at random locations with a small diameter rod graduated in centimeters. The rod is placed vertically in the normally spreading vegetation. Heights are recorded for each point where vegetation touches (strikes) the rod at each location sampled. Sampled fields were divided into three categories: fields without nests, fields with 50 percent or more of nests successful, and fields with less than 50 percent of nests successful. Mean maximum height (MMH), mean height at all strikes (MH), and mean height at which strikes occur within each consecutive centimeter of height (MHCS) showed a consistent relationship to nest success (Table 1). In nearly every case, fields without nests had the shortest vegetation, fields with less than 50 percent nest success had the tallest vegetation, and fields with greater than 50 percent nest success had vegetation of intermediate height. The only exceptions occurred in 1978. We speculated in MWRL 21(9):3 that the heavy snow cover in the winter of 1977-78 may have flattened the preferred grass cover (the higher cover) thus reducing its height and increasing its density at lower heights. Fields with highest nest success had the lowest MMH and MH values in 1978 and the highest density in the lowest height class (77.8 percent versus 67.7 percent for fields with no nests and 71.2 percent for fields with less than 50 percent nest success), confirming our speculations.

These findings indicate that "predator-resistant" nest cover (MWRL 19(10):3) may, in fact, exist and that it is a "happy medium" between cover that is too short and thin to attract nesting hens and cover that is so tall and thick that it attracts nest predators or makes prairie chicken nests more susceptible to predation. Future reports will elaborate on the relationship between vegetation density and nest success and the methods we may use to establish and maintain the "best" nest cover.

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1. The first part of the report deals with the general situation of the country and the results of the survey. It is divided into two main sections: the first section deals with the general situation of the country and the results of the survey, and the second section deals with the specific results of the survey.

(b) (7)(C), (D) - Review your classification and ensure that it meets the requirements of the law. If you are unsure, consult with your supervisor or the appropriate legal counsel.

Table 1. Vegetative structure related to nest success for prairie chickens, 1976-1978.

	MMH	MH	MHCS	MD
1976 Fields				
Without nests	51.3	10.1	5.1	23.7
With nests, success $\geq$ 50%	70.4	10.8	6.0	28.4
With nests, success $<$ 50%	76.4	13.4	8.2	32.8
1977 Fields				
Without nests	41.9	8.8	3.0	19.0
With nests, success $\geq$ 50%	62.9	9.5	3.0	20.0
With nests, success $<$ 50%	67.6	12.0	4.0	23.5
1978 Fields				
Without nests	58.1	12.3	3.5	18.7
With nests, success $\geq$ 50%	57.2	7.9	4.4	21.6
With nests, success $<$ 50%	68.2	12.4	4.6	24.8
1976-78 Fields				
Without nests	48.7	9.9	4.1	21.4
With nests, success $\geq$ 50%	64.6	9.8	4.4	23.6
With nests, success $<$ 50%	71.6	12.9	6.0	28.2

MMH = Mean maximum height (cm)

MH = Mean height (cm)

MHCS = Mean height of consecutive strikes (cm)

MD = Mean density (percentage occurrence to 30 cm)

1956-1957				
Year	Area	Population	Area	Population
1956	100	100	100	100
1957	100	100	100	100
1958	100	100	100	100
1959	100	100	100	100
1960	100	100	100	100
1961	100	100	100	100
1962	100	100	100	100
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2018	100	100	100	100
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2020	100	100	100	100

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APR 9 1979

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

March, 1979

Vol. 22, No. 3

Manipulation of Pheasant Habitat

R. E. Warner

Populations of ringnecks were censused by helicopter during January-February 1979 on four areas in east-central Illinois: the Sibley Study Area (SSA), Ford County Management Unit (FCMU), Anchor township (McLean County), and Prairie Green township (Iroquois County). Roadsides were seeded on the FCMU in 1968, and seeded roadside vegetation is in the process of development on the township areas. The SSA is considered a reference area, where management activities have been minimal. Another area of ongoing investigation, Harwood township (Champaign County), was not censused by helicopter this winter.

The 1979 aerial census is summarized in Table 1 and compared with a similar count taken in January 1977; the 1977 count was taken prior to the winter-storm-related mortality that occurred in both January 1977 and in the winter of 1977-78. The decline in numbers of pheasants indicated by the 1979 count ranged from 77% (FCMU) to 94% (Prairie Green) over the two-year period. The magnitude of declines noted by helicopter censuses are generally congruent with the findings of other census methods applied seasonally to the areas.

The 1979 aerial counts did not detect any evidence of extensive winter storm-related mortality of pheasants on the areas during the 1978-79 cold season. Although the winter of 1978-79 brought record snowfall to many parts of east-central Illinois, precipitation was not accompanied by the severe wind chill factors (60°-to-80° F below-zero) documented for the previous two winters.

Table 1. Helicopter censuses of pheasants on five study areas in east-central Illinois, 1977 and 1979.

Area	1977		1979	
	Number of Sections censused	Pheasants per section	Number of Sections censused	Pheasants per section
SSA ¹	36.25	9	36.25	1
FCMU ²	20	30	32	7
ANCHOR	16	8	32	1
HARWOOD ³	16	5	--	--
PRAIRIE GREEN	16	26	42	2

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- ¹A December 1973 census indicated 62 pheasants/section.
- ²A December 1973 census indicated 111 pheasants/section.
- ³The Harwood area was not censused in 1979.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

As discussed in last month's newsletter, we counted all leaf nests on 48 ha of woodland for several years. In addition, we recorded the species, dbh, and canopy (dominant, codominant, or suppressed) of the tree containing the nest; condition of the nest (usable or unusable); height of nest; and vines associated with the nest. A complete count of trees (≥ 5 inches dbh) was available so that a statistical comparison (χ^2 tests) could be made to determine if fox squirrels selected leaf-nest trees at random.

Fox squirrels selected white oak and beech as sites for leaf nests more often than expected; black oak, tight-bark hickories (mockernut, pignut, and bitternut), sugar maple, black walnut, ash, and red oak in proportion to their abundance in the woods; and shagbark hickory less often than expected. Of the leaf nests built, white oak and beech contained more usable nests than expected; sugar maple, red oak, and tight and shagbark hickories had an expected number of leaf nests; and black oak, black walnut, and ash had fewer usable nests than expected.

Because such factors as harsh weather can destroy leaf nests or render them unusable, and because leaf-nest durability may depend in part on characteristics of the tree, we evaluated leaf-nest loss from fall to spring in relation to tree species. Although tight-bark hickories tended to lose slightly more nests than other species and white oak fewer, chi-squared tests indicated that there was no significant relationship between nest loss and tree species. In next month's newsletter we will discuss factors that might influence the selection of a leaf-nest tree and its usability.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

In MWRL 22(2):2, we presented the relationship between nest success of prairie chickens and the height and density of nest cover. Vegetation in fields with the highest (≥ 50 percent) nest success was of intermediate height: taller than in fields with no nests and shorter than in fields with low (< 50 percent) nest success.

Density of vegetation (percentage of strikes by vegetation on the sampling rod by height class), showed the same relationship to nest success as height of vegetation (Table 2). Fields with high nest success had vegetation of intermediate density: denser than fields with no nests and less dense than

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fields with low nest success. This relationship held true regardless of annual variation in cover density. For example, fields with <50 percent nest success in 1977 (the densest cover of 1977) had density values nearly identical to those of fields without nests in 1976 (the least dense cover of that year).

Further evaluation of nest density versus nest success will be necessary before we can conclude that the intermediate cover is, in fact, "predator-resistant." It may be that nest density is a more important factor in protecting nests from predators than vegetation height and density.

Table 2. Density (percent occurrence) of vegetation related to nest success of prairie chickens, 1976-1978.

Height class (cm)	1-5	6-10	11-15	16-20	21-25	26-30	$\bar{X}$ (to 30 cm)
1976 Fields							
Without nests	69.4	36.8	16.5	10.3	5.6	3.6	23.7
With nests, success $\geq 50\%$	71.1	42.9	24.7	15.1	9.3	7.4	28.4
With nests, success <50%	82.1	53.1	27.0	17.9	10.2	6.7	32.8
1977 Fields							
Without nests	56.5	28.4	13.9	7.4	4.4	3.2	19.0
With nests, success $\geq 50\%$	61.2	30.8	14.2	6.9	4.0	2.8	20.0
With nests, success <50%	69.1	35.4	17.7	9.9	5.3	3.7	23.5
1978 Fields							
Without nests	67.7	24.7	9.3	3.3	3.5	3.4	18.7
With nests, success $\geq 50\%$	77.8	30.7	9.1	5.1	3.3	3.3	21.6
With nests, success <50%	71.2	38.6	18.6	8.9	5.7	6.1	24.8
1976-78 Fields							
Without nests	64.5	32.3	14.7	8.4	4.9	3.4	21.4
With nests, success $\geq 50\%$	68.4	35.5	17.2	9.7	5.9	4.7	23.6
With nests, success <50%	75.8	44.6	22.3	13.3	7.7	5.8	28.2

The first part of the report deals with the general situation of the country. It is a very interesting and informative study of the country's development and progress. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country's development.

The second part of the report deals with the economic situation of the country. It is a very interesting and informative study of the country's economic development and progress. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country's economic development.

The third part of the report deals with the social situation of the country. It is a very interesting and informative study of the country's social development and progress. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country's social development.

The fourth part of the report deals with the political situation of the country. It is a very interesting and informative study of the country's political development and progress. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country's political development.

The fifth part of the report deals with the cultural situation of the country. It is a very interesting and informative study of the country's cultural development and progress. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country's cultural development.

The sixth part of the report deals with the environmental situation of the country. It is a very interesting and informative study of the country's environmental development and progress. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country's environmental development.

The seventh part of the report deals with the international situation of the country. It is a very interesting and informative study of the country's international development and progress. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country's international development.

The eighth part of the report deals with the future of the country. It is a very interesting and informative study of the country's future development and progress. The author has done a great deal of research and has gathered a wealth of material. The report is well written and is a valuable contribution to the study of the country's future development.

MAY 9 1979

MONTHLY WILDLIFE RESEARCH LETTER

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Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

April, 1979

Vol. 22, No. 4

Manipulation of Pheasant Habitat

R. E. Warner

In last month's newsletter (MWRL 22(3):1), trends in the abundance of pheasants on 5 areas--the Ford County Management Unit (FCMU), Sibley Study Area (SSA), Anchor, Harwood, and Prairie Green--were reviewed relative to winter-storm-related mortality noted in January 1977 and during the winter of 1977-78. Documented mortality from exposure to winter storms provides opportunity for evaluating the importance of woody vegetation to survival of ringneck populations during such severe weather conditions in east-central Illinois.

In January and February 1979, existing woody vegetation was recorded on 36-square-mile maps of each area. On each area, 9 subunits were delineated, comprised of 4 sections (2 x 2) per subunit; a cock call count station was located at the center of each subunit.

Two indices were applied to measure woody vegetation on the subunits: (1) a linear measurement was made of occasional or continuous trees and shrubs (nearly all woody vegetation on the areas exists in linear strips as hedgerows or along tributaries), and (2) a circle with a 1-mile radius was inscribed on a map of each subunit; the number of intersections of the circle and woody vegetation was then tallied.

Linear measurements of woody vegetation on the areas (summation of 9 subunits per area) totaled 15.34, 19.87, 22.03, 31.16, and 47.13 kilometers on the FCMU, SSA, Anchor, Harwood, and Prairie Green, respectively. The number of intersections of woody vegetation and circles totaled 13, 16, 15, 20, and 41 for the FCMU, SSA, Anchor, Harwood, and Prairie Green, respectively.

In next month's newsletter, declines in cock calls from 1976 to 1978 will be considered relative to indices of woody vegetation on each subunit.

Ecology and Management of SquirrelsC. M. Nixon,
L. P. Hansen

As indicated in last month's newsletter, fox squirrels often select particular species of tree as sites for leaf nests. To determine what tree characteristics attract fox squirrels, we looked at some of the physical attributes of the most suitable trees.

We compared the number of leaf nests built in 2 size classes of tree, 6-10 and 12-20+ inches dbh, and found larger trees had significantly more leaf

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nests than expected on the basis of number present and smaller trees significantly fewer. This apparent preference for larger trees might affect tree species selection on which we previously reported (MWRL 22(3):2), since different species may have different size distributions. When size classes were analyzed separately, however, the only difference from that previously reported as that smaller black oaks were selected more often and larger black oaks less often than expected, and shagbark hickories 12 inches and larger dbh were selected about as often as expected.

The most striking characteristic of the leaf nests counted was the high proportion built in vines (83%). Of these nests, 96% were in grape, 4% in Virginia creeper, and less than 1% in poison ivy. Since only 16% of all trees counted had vines, it is apparent that fox squirrels usually selected trees with vines in which to build their nests. Although vines are obviously important, tree species that most frequently have vines were not necessarily most often used for nest building. For example, a higher proportion of black walnut, sycamore, and black oak had vines than any other species, yet they received only average use as leaf nest trees. White oak and beech had significantly fewer vines than other species yet contained significantly more nests. Other factors such as branch structure may be important. For example, beech was the most attractive tree to fox squirrels for nest building, yet over half of the nests in beech were not built in a vine. The highly dissected branches of beech apparently provide a suitable base on which to build a nest.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

Prairie chicken populations near Bogota, Farina, Kinmundy, Mt. Erie, and Hoyleton have been censused in the spring for 17, 17, 16, 17, and 11 consecutive years, respectively. Census was taken in 1979, as in past years, through booming-ground surveys and supplementary observations made by visitors in blinds almost daily at Bogota from 24 March through 22 April.

Counts made this spring (1979) totaled 112 cocks, down 10% from the 124 cocks censused on the 5 areas in 1978. Thus, the total number of native prairie chickens in Illinois this spring may be estimated at 224 by assuming a 50:50 sex ratio.

Prairie chicken populations showed a slight decline of 4% on the areas with sanctuaries for nesting (Bogota, Farina, and Kinmundy) and dropped 67% since the spring of 1978 on the unmanaged areas (Mt. Erie and Hoyleton). The flock at Bogota dropped from 74 cocks in 1978 to 68 cocks in 1979 and remained 27% below the long-term mean. The flock at Farina contained 21 cocks in 1978 and 22 cocks in 1979 but remained 28% below the long-term mean. The flock at Kinmundy contained 17 cocks in 1978 and 18 cocks in 1979, 24% above the long-term mean.

The flock near Mt. Erie in Wayne County may have disappeared completely. Five males were counted there in the spring of 1978, but no prairie chickens were seen or heard during 2 prime mornings for censusing this spring. Several

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fields of grass suitable for nesting were still present at Mt. Erie during the census in 1978 but were plowed by this spring. It can be surmised that prairie chicken reproduction at Mt. Erie was nil in 1978 and the last remnant birds "moved to oblivion." When this subproject was initiated in 1963, Wayne County contained the largest population of prairie chickens in Illinois.

The flock near Hoyleton in Washington County thus becomes the last unmanaged flock of native prairie chickens in Illinois. Four males were censused on their traditional booming ground at Hoyleton this spring. This flock persisted with numbers as low as 2, 3, and 4 cocks in 1971, 1973, and 1970, respectively. The highest count was 11 males in 1976. Several fields of red clover provide the most likely nest cover for prairie chicken hens at Hoyleton, but these fields are certain to be mowed for hay or plowed before hatching is possible.

The relative stability of the flocks having access to nest sanctuaries was reassuring. Nest success of prairie chickens at Bogota in 1978 was only 35% due to mammalian predation and interactions with pheasants. Also, wheat was absent on private land adjacent to the sanctuaries at Bogota in 1978 due to the wet fall of 1977, which prevented seeding of wheat. We believe wheat is important to prairie chickens for (1) brooding and roosting cover, (2) greens in early spring, and (3) grain in summer and fall. However, the decline in the flock at Bogota in Jasper County was less than we had feared.

In the next newsletter we will discuss the improved distribution of the breeding population and the improved cover at Bogota.

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NATURAL HISTORY SURVEY

MONTHLY WILDLIFE RESEARCH LETTER

JUN 5 1979

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Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

May, 1979

Vol. 22, No. 5

Manipulation of Pheasant Habitat

R. E. Warner

Severe winter storms of January 1977 and of the winter of 1977-78 decimated ringneck populations and provided an opportunity to evaluate the importance of woody vegetation to the survival of pheasants during severe winter weather. A multiple correlation model to evaluate this importance was developed from data collected from the 5 study areas: Ford County Management Unit (FCMU), Sibley Study Area (SSA), Anchor, Harwood, and Prairie Green.

To facilitate data collection, the study areas were divided into 45 subunits: 9 subunits per area, 4 sections (2 x 2) per subunit. Two parameters of woody vegetation on each subunit were compared (MWRL 22(4):1).

Pheasant populations were estimated from cock call counts made from stations located at the center of each subunit. These counts have been conducted since 1976 with the assistance of personnel from the Department of Conservation. Trends in the abundance of pheasants as indicated by cock call counts in May have been congruent with other census methods applied to the areas.

Weather data were not included in the regression model because information from weather stations near the study areas was insufficient to detect differences in the severity of the storms that killed large numbers of pheasants. Other data not included were the presence of herbaceous and residual row crop cover.

Independent variables in the regression test, including data for each of the 45 subunits, were (1) cock calls per 2-minute stop in 1976, (2) cock calls per 2-minute stop in 1978, (3) intersections of woody vegetation (linear and non-linear tracts) with a circle with a 1-mile radius, (4) total woody vegetation--a linear measurement of trees and shrubs in continuous and semi-continuous spacing along field borders, railroad tracks, farmsteads, and tributaries, (5) linear measurements of continuous woody vegetation (semi-continuous tracts excluded), (6) linear measurement of continuous woody vegetation with a north-south orientation, and (7) linear measurement of continuous woody vegetation with an east-west orientation. The dependent variable was the change in number of cock calls from 1976 to 1978.

The two primary indices of woody cover--the circle-intersect sampling (variable 3) and measurement of total linear vegetation (variable 4)--were significantly correlated ($r = .60$; $p < .001$). However, none of the independent variables (3 through 7) that described woody vegetation were of importance in the regression model (correlation coefficients were not significantly different than $r = 0$).

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The only independent variable of significance in the model was the number of cock calls in 1976 (variable 1). The pre-storm (1976) population of cocks explained 22% of the variation in the magnitude of pheasant declines that occurred on the subunits from 1976 to 1978 ($r = .47$; $p < .01$); mortality rates of pheasants over the period were greatest for areas with relatively high densities of pheasants.

The survival rates of pheasants during severe winter weather were not explained by the substantial differences in woody cover on the areas (MWRL 22(4):1). This lack of correlation between survival rates and woody cover may, in part, be explained by pheasant behavior--a factor not considered in the regression model. Daily movement patterns of pheasants in east-central Illinois are typically from woody vegetation during the day to roosts at night in low, herbaceous cover of hay or stubble fields, even during the most adverse winter weather.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

As mentioned previously, squirrels generally build more leaf nests than they maintain. Some authors suggest that fox squirrels abandon a nest after a short period of use because of the accumulation of parasites and detritus. It is also possible that some nest sites offer little protection from weather extremes, thus leading to early deterioration of the nest. In this newsletter we examine characteristics of leaf nests as they relate to usability.

Usable leaf nests throughout the year tended to be slightly, although significantly, higher in the tree than unusable leaf nests ($\bar{X} = 42.5$ and 40.4 feet, respectively). Also, significantly more of the usable leaf nests counted were in dominant or codominant trees than in suppressed trees. Trees of larger dbh (12-20+ inches), however, did not contain proportionately more usable leaf nests than trees of smaller dbh (6-10 inches). It appears, therefore, that higher leaf nests in dominant or codominant trees are more durable or at least are maintained longer.

We also evaluated the influence of vines on the usability of leaf nests and found that significantly fewer of the usable leaf nests than expected were in vines. It may be that by blowing the vine around, wind action reduces the durability of leaf nests built in vines.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

In the springs of 1978 and 1979, 80% and 79%, respectively, of the prairie chicken cocks at Bogota were concentrated on 23% of the sanctuary acreage--specifically the 232-acre Yeatter-Field-McGraw unit. Similarly in 1978, 63% of the hen population observed during booming season was located on this key unit. Subsequently, a high density of 42 prairie chicken nests was found in 196 acres of nest cover on the unit, but due to predation and interactions with pheasants, nest success dropped to the all-time low of 24% hatched.

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However, this spring, 1979, 46% of hens observed on booming grounds at Bogota were seen on the Yeatter-Field-McGraw unit--about average for the previous 16-year period. On 3 other sanctuary units (Donnelley, C. McCormick, and J. McCormack), proportionately high numbers of hens were observed this spring despite low numbers of cocks. Thus, a more favorable distribution of the breeding flock (i.e. hens) appears evident at Bogota.

This spring, in contrast to the spring of 1978 (MWRL 22(4):3), sizable acreages of wheat are again present on private land adjacent or near each of the 7 sanctuary units. The wheat acreage plus 123 acres of new grass-legume seedings and 80 acres of prescribed burns (March 1979) on the sanctuaries should afford quality cover for broods in 1979. Due to major renovation and improvement, particularly on the Galbreath and C. McCormick sanctuaries, there should be 815 acres of nest-brood cover on the 1,001 acres of sanctuaries at Bogota in 1980. This will be the highest proportion of cover attained to date on the Bogota sanctuaries. Expansion of the Federal Feed-Grain Program may add somewhat to this more favorable habitat outlook.

MONTHLY WILDLIFE RESEARCH LETTER

JUL 11 1979

Illinois Federal Aid Project W-66-R

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Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

June, 1979

Vol. 22, No. 6

Manipulation of Pheasant Habitat

R. E. Warner

Breeding pheasants were censused in 1979 on 5 areas by biologists from the Illinois Natural History Survey and the Department of Conservation. These areas included the Ford County Management Unit (FCMU) and Sibley Study Area (SSA) in Ford County, Anchor Township in McLean County, Harwood Township in Champaign County, and Prairie Green Township in Iroquois County. Audio censusing of cock pheasants was conducted on all areas in May 1979. In addition, visual counts of pheasants were made on the SSA and FCMU in late April and May. The SSA and FCMU have traditionally been censused as a part of this project; censusing of the other areas began in 1976. Roadsides on the FCMU were seeded in 1968, Anchor and Harwood townships in 1976, and Prairie Green in 1977.

Trends in cock call counts on the 5 areas are listed for the past 4 years in Table 1. Cock call counts from 1978 to 1979 remained about the same on the SSA, FCMU, and Harwood areas, declined on the Anchor area, and increased substantially on Prairie Green (Table 1).

Spring visual counts on the FCMU and SSA were conducted along standardized routes. On the SSA, 5.3 cocks were observed per 100 miles of driving in 1979 compared with 6.4 in 1978, 22.8 in 1977, and 117.5 in 1976. On the FCMU, 10.8 cocks were observed per 100 miles in 1979 compared with 6.9 in 1978, 30.8 in 1977, and 123.5 in 1976--indicating a moderate increase in breeding pheasants in 1979 from the previous spring.

Censuses were initiated on the Anchor, Harwood, and Prairie Green areas primarily to evaluate pheasant response to roadside management. To make such an evaluation, census activities on these areas must be continued for several years because of extensive losses of pheasants during winter storms since 1977 and because seedings are recent.

Table 1. Cock calls per 2-minute stop on 5 areas of investigation in east-central Illinois censused in May 1976-79. Numbers represent averages of the 5 highest counts recorded per stop per year.

Area	1976	1977	1978	1979 ¹
SSA	12.8	2.8	2.0	2.8
FCMU	22.9	7.8	6.4	6.1

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1. *Phragmites australis* (Cav.) Trin. ex Steud.

Anchor	19.9	5.7	4.2	2.5
Harwood	11.8	7.1	6.1	5.5
Prairie Green	28.4	9.2	3.0	8.0

¹Due to unusually poor counting conditions, the 3 highest counts per stop were used in computing the average number of cock calls per area.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

Use of leaf nests to estimate squirrel numbers.--An essential part of sound management in any game species includes a knowledge of how populations fluctuate from year to year. Unfortunately, many state wildlife agencies cannot devote the large amount of time and effort necessary to obtain such data. A quick, simple way to estimate animal numbers would be ideal, and wildlife biologists have attempted to derive several indices of squirrel abundance. Counts of leaf nests would seem to be the most practical means of determining annual changes in squirrel numbers since nests are built every year and are easily countable, and, hypothetically, the number of nests built is directly proportional to the number of animals present.

As reported in previous newsletters, leaf nests were counted for 7 years during the fall and 4 years during the spring on 2 study plots in east-central Illinois. Trapping took place concurrently with leaf nest counts so we have a true estimate of the number of squirrels present. Linear regression analyses were run to determine if there was any relationship between the number of animals captured and the number of leaf nests during both spring and fall. No significant relationship was found in any test and the highest r^2 value obtained was only 0.26. For unknown reasons, either individual squirrels build different numbers of leaf nests each year, or annual fluctuation in sex ratios and age structure lead to changes in the number of leaf nests built. Regardless of the cause, the number of leaf nests should not be used to estimate squirrel numbers.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier,
D. R. Vance

The 8,300 acres acquired by Central Illinois Public Service Company (CIPS) in Jasper County offer potential for management of grassland for prairie chickens and other wildlife. The Department of Conservation (DOC) and CIPS entered into a 25-year lease agreement on 14 March 1979 under which DOC will manage portions of the Newton Power Station for conservation and public recreation purposes.

A tract of approximately 260 acres is included in the CIPS-DOC agreement for management of prairie chickens and other grassland wildlife. The tract is located about 0.8 mile from the nearest (Otis-Fuson) prairie chicken sanctuary. Emphasis will be on attracting prairie chickens from the Bogota flock to the

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managed tract. However, management of grassland on the CIPS area as well as on the existing sanctuaries should be viewed in a broader context than prairie chickens. Four other species classified as endangered or threatened in Illinois should benefit--the upland sandpiper, harrier, short-eared owl, and Henslow's sparrow--as well as upland game and grassland songbirds. The 1,755-acre Newton Lake borders the west side of the prairie chicken management tract. Thus, the prairie chicken sanctuaries should now offer potential for nesting waterfowl. Since the recent development of the Newton Power Station, the first mallard nest was found in 1977 (Donnelley Sanctuary), and a broody blue-winged teal was observed on the McCormick Sanctuary in 1978. As of 14 June 1979, 4 mallard nests were found or reported this year on or near sanctuaries. These nests were up to 4 miles from Newton Lake.

The total acreage and distribution of woodland on much of the land surrounding the lake present a problem for management of prairie fauna. Many potentially useful fields are too enclosed by woodland to be attractive to prairie chickens; some reduction of existing woodland will be essential. Prescribed burning will be an important tool of grassland management on the Newton Power Station. The tract to be managed includes 60 acres of open pasture; about 55 acres of cropland, which will need to be seeded to nest cover; and 22 acres of old field and 11 acres of seeded prairie grass, both of which are being invaded rapidly by trees and shrubs.

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MONTHLY WILDLIFE RESEARCH LETTER

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Glen C. Sanderson and Eva Steger, Editors

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Manipulation of Pheasant Habitat

R. E. Warner

News reporters and public agencies frequently request an estimate of the amount of pheasant habitat in Illinois that has been destroyed or reduced in value for pheasant reproduction and survival over the last 15 years.

Two obvious changes in land use that have influenced the abundance of pheasants are the loss of farmland to urbanization and the increased planting of row crops. Using Cooperative Crop Reporting Service data, such changes were recently considered for 7 crop reporting districts that encompass the range of self-maintaining populations of pheasants in Illinois.

Farmland cover of primary importance for pheasants is compared in Table 1. These data indicate that over the 15-year period approximately 2.4 million acres of hay and small grains and 1.8 million acres of uncultivated farmland in the Illinois pheasant range were converted to other uses. The loss of habitat for pheasants has been proportional to increased production of corn and soybeans. During this same period, over 2 million acres of agricultural land were lost to encroaching metropolitan areas, particularly in the northeastern counties.

Table 1. Farmland (reported in thousands of acres) and the percent of total farmland devoted to hay and small grains and uncultivated areas in Illinois' pheasant range, 1962 and 1977.

Year	<u>Hay & Small Grains^a</u>		<u>Uncultivated Farmland^b</u>		Total Farmland
	Acres	Percent	Acres	Percent	
1962	4,366	17.3	4,015	15.9	25,196
1977	1,999	8.6	2,227	9.6	23,178
Change: 1962-1977	-2,367	-54.2	-1,788	-44.5	- 2,018

^aIncludes hay, hay pasture, wheat, oats, barley, and rye.

^bIncludes set-aside acres, wood lots, and idle farmland.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

Selection cutting (removal of single trees or small groups of trees) is practiced on many hundreds of acres of Illinois' forests each year, yet little is known regarding the effects of this practice on wildlife.

We studied the short term (1-2 years postcutting) effects of selection logging on gray and fox squirrels using 3 study areas. Two areas, the 44-acre Massac and the 34-acre Old Barn, are located in Pope County and are a part of the Shawnee National Forest. The 39-acre Cole area is located on private land in Vermilion County. Oak-hickory forests dominated all 3 tracts, with some tuliptree, ash, black walnut, beech, and sugar maple also present.

Trees were marked for cutting by a forester and removed by a commercial logger. We made no attempt to influence either the tree marking or logging operations because we wished to evaluate the typical cutting operation as practiced in Illinois.

Cutting intensity varied among areas, with tree removal ranging between 37% and 55% of the basal area for trees of merchantable size (≥ 14 inches dbh). Cutting intensity was heaviest at Massac and lightest at Old Barn. At Massac, a mixture of oaks and hickories were cut, but 2 species, red oak and white oak, made up more than 50% of the trees removed at Old Barn and Coles, respectively.

We found that these timber cuttings had no significant effect on squirrel densities, recovery rates (squirrels tagged one year and recovered the next year), movements, or breeding rates. In fact, squirrel captures in live traps increased on all 3 areas the year after logging. We did find that adult male fox squirrels tended to avoid the center of the cuttings whereas gray squirrels of both sexes were attracted to the center of cuttings at Massac and Old Barn. We postulate that gray squirrels, particularly those < 15 months old, are attracted to the insects and fungi that abound on logging slash the first few years after logging.

We will discuss the effects of selection cutting on the availability of food and shelter for squirrels in the next report.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier

Two problems of paramount concern in current efforts to preserve prairie chickens in Illinois are (1) predation on prairie chicken nests and (2) competition, harassment, and nest parasitism by pheasants. Nest success at Bogota has been below the critical level of 50% during 5 of the past 6 summers primarily because of these 2 factors. The flock at Bogota (68 cocks) in the spring of 1979 was 27% below the 1963-78 mean (93 cocks) (MWRL 22(4):2-3) and was 67% below the phenomenal population level of 206 cocks present in the spring of 1973.

However, a comparison of nest numbers and nest densities of prairie chickens relative to other nesting fauna reveals the dependence by prairie chickens on associated grassland species that act as buffers to predation. Nest densities are used as an index of population levels for 12 species of birds and 3 species of mammals (Table 1). In 1978, prairie chicken nests found on sanctuaries were 129% of the mean for the 12-year period of 1966-77. This figure was exceeded only by percentages for the pheasant and the endangered upland sandpiper. By contrast, quail, mourning dove, meadowlark, and grasshopper sparrow showed record low densities among the species that nest on the ground.

Among 5 species that nest off the ground in grasses and forbs, only the red-winged blackbird approached an average nest density. Densities of cottontail nests in 1978 were 200% above the 12-year mean. However, by excluding a "hot spot"--a prairie restoration area (Walters 40) that was searched for the first time in 1978--cottontails were 93% of the long-term mean. Nest densities for small mammals (prairie vole and bog lemming) were 119% of the long-term mean.

These data suggest that prairie chickens at Bogota are not doing badly compared with other birds and mammals nesting on the sanctuaries. The current low densities of 9 species of birds are apparently the result of low breeding populations due to the past 3 severe winters. A previous report (MWRL 20(12):3) showed that as the proportion of prairie chicken nests to nests of other ground nesters increased, nest success of prairie chickens declined ($r = -0.692$). Hatching success of prairie chickens above the critical 50% level and a recovery in the population level are not likely until average or greater densities of nests of the buffer species are attained.

Table 1. Numbers and densities of bird and mammal nests found on prairie chicken sanctuaries, Bogota Study Area, 1966-78. A cumulative total of 4,676 acres (357-acre annual mean) was searched.

Species	Total Nests	Annual Means for 1966-77		1978		Percent of 1966-77
		Nests	Nests/ 10 A.	Nests	Nests/ 10 A.	
BIRDS:						
Prairie chicken	599	45.3	1.26	55	1.62	128.6
Quail	297	24.3	0.68	5	0.15	22.1
Pheasant	63	4.2	0.12	13	0.38	316.7
Mourning dove	175	14.5	0.40	1	0.03	7.5
E. meadowlark	764	62.5	1.74	14	0.41	23.6
Upland sandpiper	25	1.8	0.05	3	0.09	180.0
Grasshopper sparrow	<u>49</u>	<u>4.0</u>	<u>0.11</u>	<u>1</u>	<u>0.03</u>	<u>27.3</u>
All ground nests	1,972	156.7	4.37	92	2.71	62.0

Red-winged blackbird	5,149	401.8	11.20	327	9.62	85.9
Dickcissel	753	60.9	1.70	22	0.65	38.2
Field sparrow	166	13.3	0.37	6	0.18	48.6
Short-billed marsh wren	29	2.3	0.07	1	0.03	42.9
Goldfinch	<u>27</u>	<u>2.2</u>	<u>0.06</u>	<u>1</u>	<u>0.03</u>	<u>50.0</u>
All off-ground nests	6,124	480.6	13.39	357	10.50	78.4
All bird nests	8,096	637.3	17.76	449	13.21	74.38

MAMMALS:

Cottontail rabbit	206	14.8	0.41	28	0.82	200.0
Small mammals	24,227	1,845.8	51.44	2,077	61.09	118.8

Ecology and Management of White-tailed Deer

C. M. Nixon,
L. P. Hansen

The Department of Conservation (DOC) and the Natural History Survey are cooperating on a new project dealing with the management of white-tailed deer in Illinois. The new project has 3 main objectives:

1. Deer Range Appraisal for Illinois

Objectives:

- a. To define those characteristics of the Illinois landscape that determine the presence or absence of deer, particularly in winter.
- b. To design statistically valid sampling procedures for measuring these characteristics.
- c. To develop sampling procedures flexible enough to allow measurement of important landscape characteristics (such as presence of forests, understory density, fruit and seed production, and browse availability within the framework of future land use inventories.
- d. To provide the DOC with an up-to-date appraisal of the quality and quantity of deer range in Illinois.

2. Deer Movements and Habitat Use in Winter

Objectives: To determine winter movement patterns and habitat use by deer in central Illinois using deer marked with radio transmitters, neck collars, and ear streamers.

3. Modeling of Illinois Deep Populations

Objectives:

- a. To construct working models of the factors affecting the abundance and distribution of deer in Illinois using harvest information and estimates of natural mortality and reproduction.
- b. To project the future of regional deer herds under various levels of harvest using these models.
- c. To integrate harvest strategies developed from these models with the statewide deer range appraisal to provide the DOC with an appraisal of the future prospects for the Illinois deer herd.

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Manipulation of Pheasant Habitat

R. E. Warner

The chronology of roadside mowing has been monitored annually on the Ford County Management Unit (FCMU) since 1970. Cooperators in the roadside seeding program initially agreed in 1968 to delay roadside mowing each year to at least 1 August. This summer (1979), approximately 61% of the roadsides seeded on the FCMU remained unmowed as of 1 August. On the same date, 1970 through 1978, the percentages of cooperator miles unmowed were 72, 81, 78, 89, 87, 63, 64, 48, and 60, respectively.

A sample of 83 miles of seedings on previously graded roadsides scattered throughout Ford County was also monitored for chronology of mowing. As of 1 August 1979, approximately 68% of the seedings remained unmowed; 53% and 56% of the seedings remained unmowed through this date in 1977 and 1978, respectively. Thus, cooperation by participants in delayed mowing over the past 3 years has been similar for the block (FCMU) and scattered roadside seedings.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

We studied the effects of selection cutting on the availability of shelter (tree cavities and leaf nests) and food for squirrels on 3 study areas: Massac, 44 acres; Old Barn, 34 acres; and Cole, 39 acres.

Using binoculars, tree cavities suitable for sheltering squirrels were located by systematic searching of each study area before and after logging. Cavities were judged to be suitable for use by squirrels as all-weather shelter or as escape shelter only.

Tree removal reduced the number of tree cavities suitable for sheltering squirrels on all study areas; all-weather cavity losses averaged 54%.

Logging did not change the proportionate abundance of tree cavities by species on any study area, because those species most prone to form cavities were not removed by loggers. At Old Barn, of the larger trees (>10 inches dbh), sassafras, elm, and beech contained significantly more cavities than expected; these species were not cut to any extent. At Cole, sugar maple and beech contained

more cavities than expected and were not extensively cut; white oak and walnut, the species most affected by logging, had significantly fewer cavities than expected. At Massac, tree cavities were distributed by species according to their abundance both before and after logging.

Cull trees were not removed, thus ensuring that many trees containing cavities remained on each study area.

Leaf nests were counted each fall on the Massac and Cole areas but not on the Old Barn area where leaf nests were scarce. Nests were classified as used or abandoned by squirrels according to nest integrity.

Before logging at Cole, squirrels built leaf nests significantly more often in white oak, the hickories, and black oak than the abundance of these species would indicate; they built significantly less often in black walnut and elm. After logging, squirrels built significantly more nests than expected in sugar maple, a species not cut by loggers. Numbers of fall leaf nests at Cole declined after logging. At Massac, squirrel preference for leaf nest sites shifted from black oak before logging to shingle oak after logging. Significantly fewer nests than expected were built in sweet gum before and after logging on the Massac area. After logging, leaf nest construction at Massac increased only slightly, suggesting that shelter was not a significant problem for the resident squirrels.

To study the effects of selection cutting on food supplies for squirrels, we determined the number of selected tree species needed to provide food for 2.5 squirrels per ha (1 squirrel/acre) for 180 days (October-March). Data for this stocking guide were (1) the average seed production for major trees which produce winter-storeable food, and (2) recent information on food consumption by squirrels in winter.

According to species abundance on the study areas, we assume that acorns comprise 50%, hickories 30%, and black walnut 10% of the fall and winter diet. We compared the postcutting abundance of these species on each area with our stocking guide. As shown in Table 1, both Massac and Cole appear still to have an acceptable species mix of trees of seed-bearing size. Except for hickory, the Old Barn area did not have a good species mix after logging. Fortunately, the Old Barn area also supports 4 beeches, 7 red oaks, and 2 sugar maples per acre as supplements to the staple foods listed in Table 1. Thus, logging did not appear to reduce food supplies to critically low levels on any of the study areas.

We will consider ways to minimize the effects of selection cutting on squirrels in our next report.

Table 1. Postcut abundance (no./ha) of squirrel food producers on each study area. The minimum number of trees ≥ 10 inches dbh is based on the amount of seed produced by each species and the amount of seed eaten by a squirrel in winter (October-March).

	White oak ^a	Black oak ^a	Black Walnut ^a	Mockernut hickory ^a	Shagbark hickory ^a
Minimum number of trees ≥ 10 inches dbh	12	17	2	11	14
Massac	23	18	< 1	28	< 1
Old Barn	3	3	< 1	12	7
Coles	22	6	15	5	9

^aAverage seed yields for a tree 10 inches dbh.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier

During the spring of 1979, 64 groups totaling 384 people made reservations and visited the prairie chicken booming grounds in Jasper County. The period for visitation by the public began 24 March and terminated 22 April--a total of 30 mornings. Students and staff from 17 educational institutions represented 66% of the total number of visitors. Illinois supplied 64% of the visitors, Indiana 13%, Ohio 13%, and lesser numbers came from California, Colorado, Iowa, Kentucky, Maryland, Massachusetts, Michigan, Missouri, New Jersey, Pennsylvania, Rhode Island, Tennessee and Washington, D.C. Visits were made only in early morning hours when the chickens are most active. As in previous springs, visitors aided the research project by recording their observations on standard forms during 43 blind mornings (one booming ground under observation for at least 2 hours by 1 or more observers in 1 or more blinds per morning). All visitors are briefed before going out to the blinds and debriefed upon their return from the blinds.

The peak count of hens on the booming grounds occurred on 5 April in 1979, about average compared to the previous 13 years. The first observed copulation was on 7 April, about 4 days later than average. However, the peak in copulations observed in 1979 occurred on 15 April, the latest on record--8 April is average.

Despite the highest pheasant population on record (about 25 crowing cocks) in the sanctuary area at Bogota and the continuous presence of pheasants in the immediate vicinity of the major booming grounds, there were no observed instances of conflict between prairie chickens and pheasants in the spring of 1979. A coyote was seen once and skunks were seen on 2 mornings on the main booming ground but no disturbance to the chickens was noted. As in past years, marsh hawks were the most common source of disruption on the booming grounds, but no kill or serious attack has ever been noted by harriers on prairie chickens in our 17 years of intensive observations. Visitors caused minor disruptions on 3 mornings in 1979 by leaving the blinds too early due to storm conditions, cold, impatience or a combination of these factors. Close supervision of visitors remains essential.

Ecology and Management of Deer

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

Even though winter weather in Illinois is usually less severe than the weather deer experience in more northern states, the winter months are periods of stress for the Illinois deer herd. Once the crops are harvested and leaf fall occurs, large areas of the state offer deer no protection from weather or harassment. The absence of woody cover limits the distribution of deer throughout much of Illinois, but particularly in the central, east-central, and northern counties.

In these counties, it was noticed as long as 30 years ago that deer tended to concentrate in localized habitats in winter. In the Rock River Watershed, for example, deer moved 10 miles or more to areas along the river in late fall and remained until late March or April when they dispersed back to their summer range. We have noticed a similar concentration of deer along the upper Sangamon River the past several years. If such concentrations of deer are commonly found each winter throughout central and northern Illinois, and if the same areas are used each winter, then the identification and descriptions of these areas would be of great value in future management of the Illinois deer herd.

In the coming months, we will be asking all those persons thought to be qualified to supply information regarding winter deer concentrations in selected counties.

Incat.

MONTHLY WILDLIFE RESEARCH LETTER

NATURAL HISTORY SURVEY

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Manipulation of Pheasant Habitat

R. E. Warner

Land use on the Sibley Study Area (SSA) and Ford County Management Unit (FCMU) was monitored in 1979, as in previous years, by mapping the crops and vegetative cover on fields and field boundaries. The trend on these 2 study areas since 1962 has been toward fewer acres planted in tame hay and small grains and more acres planted in row crops (soybeans and corn). On the SSA, tame hay was planted on 1.2% of the land (266 acres) in 1979, compared with 1.6% in 1978, 1.2% in 1977, and an average of 7.0% per year during 1962-69. Small grains were planted on 0.9% of the SSA (207 acres) in 1979, 0.9% in 1978, 1.4% in 1977, and an average of 8.3% per year during 1962-69. Row crops were planted on 90.6% of the SSA in 1979, 85.9% in 1978, 91.2% in 1977, and an average of 76.8% per year during 1962-69.

Trends in land use on the FCMU in 1979 were similar to those on the SSA. This year (1979) 0.9% of the FCMU (119 acres) was planted in tame hay, compared with 0.3% in 1978, and 1.0% in 1977.

In 1979, pheasant nests were studied on the FCMU for the 7th consecutive year. Densities of hatched nests in seeded roadside vegetation averaged 0.09 per acre in 1979, compared with 1.30, 1.23, 0.27, 0.48, 0.17, and 0.12 per acre in 1973-78, respectively. An estimated average of 1.1 nests per square mile hatched in nonrow-crop cover on the FCMU in 1979; estimated averages for 1973-78 were 26.3, 16.5, 8.0, 8.0, 2.2, and 1.3, respectively. In 1979, approximately 64% of all successful pheasant nests on the FCMU occurred in managed roadsides. In the 7 years of nest searches on the FCMU, 52% of all hatched nests were found in managed roadside vegetation.

Next month's newsletter will consider reproduction success and the relative abundance of pheasant broods on study areas in east-central Illinois.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

This is the last of 3 reports on the effects of selection cutting (removal of single trees or small groups of trees from forests) on squirrels. Studies were conducted on 3 areas: Massac, 44 acres; Old Barn, 34 acres; and Cole, 39 acres. In the earlier reports we discussed the effects of selection cutting on squirrel densities, survival, and breeding rates (no significant effect) (MWRL 22(7):2), and on the availability of shelter (tree cavities and leaf nests) and food for squirrels (MWRL 22(8):1-3).

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This month we consider the short-term effects of selection cutting on the availability of shelter and food for squirrels and recommend ways to minimize the effects of selection cutting on squirrels.

The selection cuts we studied did not include cull-tree removal as a part of forest management. Removal of these trees can reduce the number of tree cavities available for use by squirrels.

We did examine the impact of intensive cull-tree removal on tree cavity abundance on 4 areas on the Kaskaskia Experimental Forest, an 876 ha research forest maintained by the U.S. Forest Service in Hardin County, Illinois. In 2 mixed hardwood stands totaling 10 ha, an average of 133 inoperable (no saleable timber products) or cull trees per ha were removed; in 2 comparable stands totaling 15 ha, no cull or inoperable trees were removed. Periodic selection cuts had also removed an average of 30 trees from each area. We found a 5-fold difference in the number of tree cavities between treatments (cull removal), with treated stands averaging only 4 cavities per ha and untreated stands 21 cavities per ha. Thus, wherever cull-tree removal is practiced, some trees containing cavities should be retained for wildlife use.

The number of trees with cavities that should be retained for squirrel shelter is difficult to determine, because denning needs are not well documented for gray and fox squirrels. Gray squirrels are more likely to need tree cavities for shelter than are fox squirrels, who often prefer leaf nests.

Radio-tracking studies have shown that both species utilize from 1 to 9 shelters (tree cavities or leaf nests) scattered throughout their home range. One study in North Carolina showed that 2-3 tree cavities per acre were needed to sustain high densities of gray squirrels.

We believe that retention of 3-4 living trees with suitable cavities for squirrel denning (3- to 5-inch diameter entrance hole) is a reasonable guide for use in marking stands for a selection cut.

In Illinois, black oak, sugar maple, basswood, beech, cottonwood, sassafras, and elm have been found to form cavities readily and are the best species to retain to provide for present and future cavity formation.

To provide adequate food for squirrels in those forests where management for both timber and squirrels is important, we recommend that stands marked for selection cutting retain a mix of oak, hickory, and walnut close to that shown in Table 1. Not all stands contain each of the species shown in Table 1, but most stands in Illinois contain at least 2 and usually all of these species. Post and bur oaks may be substituted for white oak, scarlet oak for black oak, and pignut hickory for mockernut using the same stocking rates shown in Table 1. Trees selected to remain in the stand should be dominant or codominant in the canopy and should be proven seed producers (look for old nuts or shells under the tree). A good species mix will also minimize the possibility of a seed failure due to late spring frosts.

1. The first part of the report is a general introduction to the subject of the study. It discusses the importance of the study and the objectives of the research.

2. The second part of the report is a detailed description of the methodology used in the study. It includes information about the sample size, the data collection methods, and the statistical analysis techniques.

3. The third part of the report is a presentation of the results of the study. It includes a summary of the findings and a discussion of the implications of the results. The results show that there is a significant relationship between the variables studied, and the findings have important implications for the field of research.

4. The fourth part of the report is a conclusion and a list of references. The conclusion summarizes the main findings of the study and provides a final statement on the research. The references list the sources of information used in the study.

5. The fifth part of the report is an appendix containing additional information related to the study. This includes raw data, detailed calculations, and other supporting materials.

6. The sixth part of the report is a bibliography of the literature cited in the study. It provides a comprehensive list of the sources used to inform the research.

7. The seventh part of the report is a list of figures and tables. These visual aids are used to present the data and results in a clear and concise manner.

8. The eighth part of the report is a glossary of terms used in the study. It provides definitions for the key concepts and variables, ensuring that the reader has a clear understanding of the terminology.

Table 1. Minimum abundance of squirrel-food producers needed to support a squirrel density of 1/acre in winter. The number needed for each species is based on average seed yields and the amount of seed of each species eaten by squirrels in winter (October-March).

	White oak	Black oak	Black walnut	Mockernut hickory	Shagbark hickory
Minimum number of trees 10 inches or greater dbh per acre	5	7	1	4	6

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier

Analysis of the annual population changes of prairie chickens with estimated nest success for the past 16 years at Bogota revealed a significant correlation ($r = 0.519$, $p < 0.05$). The line of regression intersected the level of no change in the population at 45.4% nest success. Viewed another way, during 5 selected years when mean hatch success was 36.9%, the population showed declines ranging from 17.7 to 35.4%. During 7 selected years when hatch success averaged 47.9%, the Bogota flock showed relative stability. The dramatic increases recorded for the 4 years, 1968-71, occurred when nest success averaged 63.6%. Thus, it appears that success of nests must approximate 50% for a population of greater prairie chickens to maintain its numbers at Bogota.

This summer 33 prairie chicken nests were found in 389 acres of sanctuary grasslands at Bogota. Hatch success was 43.8% (14 hatches among 32 nests of known fate). Thus, 1979 is the 6th year among the past 7 years that hatch success has been below the critical level of 50%. However, nest success was probably greater than the 44% indicated above. Due to the inexperience of the search crew, some hatched nests were overlooked this summer. For example, 3 prairie chicken hatches, 1 pheasant hatch, and 1 prairie chicken nest destroyed by predation were missed by the search crew in a 5-acre field on the Yeatter Sanctuary. These nests were found after the mixed prairie grasses and domestic grasses were mowed and baled for hay by the lessee. Hatched nests are generally more difficult to locate than destroyed nests because the egg shells in a hatch often remain in a neat pile in the nest bowl. The shells from eggs destroyed by predators are usually scattered around the nest bowl and therefore are more visible.

All unsuccessful nests found this summer were destroyed by predators, primarily the striped skunk. Despite the highest pheasant population on record at Bogota, there were no observed instances of nest parasitism by pheasants of prairie chicken nests in 1979 (MWRL 22(8):3-4).

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Ecology and Management of White-tailed Deer

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

While woody cover (forests, shrub habitats, pastures with woody shrubs) appears necessary for maintenance of a viable deer herd, there is more to the relationship between deer numbers and the matrix of vegetation covering Illinois than forests per se. The linear correlation between average deer harvest levels for the years 1969-73 in each county (Y) and the forest cover remaining in each county in 1962 (X) was significant ($P < 0.001$) but relatively low ($r = +0.50$ using acres of forest in each county; $r = +0.45$ using percent of each county forested). Thus, less than 25% of the variation in deer harvest levels among counties could be attributed to the amount of forest cover.

As pointed out by Roseberry et al. (1975)*, the graphic relationship between deer numbers and forest cover resembles a hyperbola, as too little or too much forest cover reduces deer numbers. At present most Illinois counties are less than 20% forested, which is probably far less than optimum for deer.

*Roseberry, J.W. Klimstra, and E. Waldhaus. 1975. Evaluation of wildlife habitat in southern Illinois 1940 vs. 1970. Unpublished data. Cooperative Wildlife Research Lab. Southern Illinois Univ. 82pp.

MONTHLY WILDLIFE RESEARCH LETTER

NATURAL HISTORY SURVEY

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Illinois Federal Aid Project W-66-R

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Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

October, 1979

Vol. 22, No. 10

Manipulation of Pheasant Habitat

R. E. Warner

May cock-call censuses indicated that the numbers of breeding pheasants in 1979 compared with 1978 were stable on the Ford County Management Unit (FCMU), Sibley Study Area (SSA), and Harwood area; declined on the Anchor area; and increased on Prairie Green (MWRL 22(6):1).

The hatch success on the FCMU in 1979 exceeded 50% for the second consecutive year. Previous nest studies show that an average of about one-third of all established pheasant nests hatch in a typical breeding season.

Broods were censused on the 5 study areas in August 1979 with the assistance of personnel from the Department of Conservation. More broods were counted per 100 miles of driving in 1979 than in 1978 on the SSA, FCMU, Harwood, and Prairie Green areas, but fewer were counted on the Anchor area (Table 1).

The average brood size on the FCMU in August 1979 appeared greater than in recent years. This larger number of chicks per hen may be primarily a function of improved survival; clutch size did not appear to be greater than average in 1979. The improved survival of chicks through mid-August in 1979 may be attributed in part to near-record densities of grasshoppers and other insects in east-central Illinois.

The 1979 census data suggest that pheasant populations on the study areas may be recovering from the wide-spread mortality of January 1977 and the winter of 1977-78. Hunter harvest data to be collected for the opening weekend of the 1979 upland game season should show a relatively large number of juveniles recruited into the fall population and a slight decline in time expended by hunters per cock harvested.

Table 1. Broods observed per 100 miles of driving in August on 5 study areas in east-central Illinois.

Year	SSA	FCMU	Anchor	Harwood	Prairie Green
1977	2.3	26.9	5.2	7.0	5.7
1978	1.0	0.6	2.0	4.3	2.5
1979	2.9	4.4	0.7	7.5	3.9

Ecology and Management of SquirrelsC. M. Nixon,
L. P. Hansen

Winter, the season most usually detrimental to wildlife populations, does not appear to be particularly difficult for gray and fox squirrels. Indeed, survival rates of marked adult fox squirrels during the past 8 winters suggest that these squirrels are more likely to survive the winter months than the spring and summer months.

The survival rate of marked adult (1.5 years +) males averaged 64% from May through September but increased to 84% from October through April. For adult females, the average survival rate increased from 72% spring-to-fall to 78% from fall-to-spring.

We believe these survival rates for adult squirrels more accurately reflect seasonal differences in mortality than would rates calculated for squirrels <1.5 years, which also reflect the high rate of egress associated with younger squirrels prior to reaching breeding age.

During spring and summer, the increased activity associated with breeding, caring for preweaned young, and caching food supplies may render adult squirrels more vulnerable to predation, disease, and accidents. In winter, adult squirrels often spend days or even weeks in a leaf nest or tree cavity. They rarely venture far from shelter except to dig 1 or 2 buried nuts and return to the snug confines of their den.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier

Management of grassland cover on prairie chicken sanctuaries in Illinois has typically involved grass seed harvesting, mowing for weed control, mowing for hay, or no disturbance the summer preceding a nesting season. Preliminary evaluation of these management approaches may be most feasible on the 232-acre Yeatter-Field-McGraw sanctuary unit because of annual consistency in nest-searching effort, high population density, and high nest density.

Among the best sample sizes, the density of established nests was highest in undisturbed cover; however, nest success was higher in meadows harvested for grass seed and both types produced the same density of hatches--1 per 4 hectares (10 acres) (Table 2). Grass seed harvesting results in (1) weather resistant stubble 35-40 cm high, (2) some weed and woody sprout control, and (3) income to help defray land taxes and management costs.

Among the 4 management categories, mowing for weed control resulted in the lowest density of hatched nests and the lowest percentage success. The poor results following weed mowing may be due to the weediness, the sparse cover density, and often the low cover height (≤ 30 cm) that characterize this category. Mowing for hay showed the highest nest success and a slightly higher density of hatched nests, but the low sample size precludes any strong conclusions about hay mowing. Typically, residual cover is lacking as a result of hay mowing, but a compensating factor may be the rapid concealment of nests when dense stands of red clover or timothy grow quickly from fertile soil. The hay-mowing category has typically involved small clutches that are indicative of late establishment or renesting.

The first part of the report is a general description of the project. It is followed by a detailed description of the methodology used in the study. The third part of the report is a discussion of the results of the study. The fourth part of the report is a conclusion and a list of references.

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To date, the data suggest that grass seed harvesting is the management category to emphasize, but not all redtop-timothy meadows are suitable for seed harvesting, hence the undisturbed category. Also, if stands of redtop and timothy go much over 1 year with no disturbance, weed and woody sprout invasion can become a problem. Brome has shown a high degree of resistance to weed invasion with minimal maintenance plus high use and success by hens. Thus brome merits greater emphasis in our management. Also, research must (1) continue to seek the best means of managing prairie grasses, and (2) demonstrate greater acceptance and success by prairie chickens (see MWRL 21(11):2-3) so that we are not limited to the cool-season-introduced grasses and legumes.

Table 2. Prairie chicken nest numbers and success according to the management prior to nesting on the Yeatter-Field-McGraw sanctuary unit at Bogota, 1963-79.

	Undisturbed	Harvested for Grass Seed	Mowed for Weeds	Mowed for Hay
Acres Searched	853	598	670	131
Nests Found	181	106	77	11
Total Nests/10 Acres	2.1	1.8	1.1	0.8
Hatched Nests/10 Acres	1.0	1.0	0.4	0.5
% Success	48.2	54.3	40.5	54.5

Ecology and Management of Deer

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

This study will be inactive until December 1, 1979.

DEC 12 1979

MONTHLY WILDLIFE RESEARCH LETTER

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Illinois Federal Aid Project W-66-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

November, 1979

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Manipulation of Pheasant Habitat

R. E. Warner

Pheasant hunters on the Sibley Study Area (SSA) and Ford County Management Unit (FCMU) were interviewed on 10-11 November 1979 to determine their hunting success during opening weekend of the upland game season. The data presented in Table 1 suggest that hunters spent more time per cock harvested in 1979 than in 1978.

The decline in hunter success this fall compared with last fall seems incongruent with the increase in numbers of pheasants on the study areas from 1978 to 1979 (MWRL 22(10):1). Without exception, hunters reported sighting more pheasants this opening weekend than 1 year ago. Twenty-two of the 26 parties interviewed sighted at least 1 cock pheasant but only 14 of the parties bagged 1 or more birds.

The unexpected decline in success by hunters is explained in part by comparing the progress of farm field activities during the last 2 fall seasons. In 1978, the harvest and subsequent disking or plowing of row crop stubble was nearly completed on the study areas by the start of the upland game season. Thus, pheasants were concentrated in comparatively few acreages of permanent or residual cover and were relatively accessible to hunters.

This fall (1979), harvest and plowing activities were behind those of 1978, although they were nearly average for the last 5 years. At the start of the pheasant season this November, a few unharvested cornfields remained on the study areas, and no more than 50% of the corn stubble was plowed. Hunters located most of the pheasants in corn stubble.

Because the numbers of hunters have declined in recent years, the proportion of residual cover actually worked by hunters in 1979 was unusually low. Pheasants flushed in corn stubble tended to flush wild, were assisted in maneuvering away from hunters by strong winds, and often relocated in fields unworked by hunters.

Table 1. Pheasant hunting statistics on the Sibley Study Area (SSA) and Ford County Management Unit (FCMU) during the 2nd weekend of November, 1973-1979.

	1973	1974	1975	1976	1977	1978	1979
Parties Interviewed ¹	28	36	28	27	18	30	26
Parties Sighting Cock Pheasants ¹	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	22
Cock Pheasants Bagged ¹	91	73	78	80	27	56	26
Percent of Birds Juvenile ¹	85	71	62	74	75	84	81
<u>Man-hours Expended:</u>							
per cock bagged; SSA	7.4	8.3	16.5	9.7	35.0	18.4	71.0
FCMU		3.1	4.7	6.2	11.6	7.9	11.1
per pheasant observed; SSA	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	2.3
FCMU							2.0

¹ Statistics: for both study areas combined.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

Foresters consider grape vines a threat to tree growth, particularly on good sites, and often recommend the removal of all climbing vines. Wildlife biologists, however, consider grape vines important food producers for many wildlife species.

In an attempt to resolve conflicts between foresters and biologists regarding grape vines, biologists in Illinois, Ohio, and West Virginia have cooperated in a study of the use of grape vines by gray and fox squirrels as anchors for leaf nest attachment.

Counts of leaf nests were made after leaf fall for 1 to 7 years on 6 study areas (1 area in West Virginia, 3 in Ohio, and 2 in Illinois). Leaf nests were recorded as usable or not usable by squirrels and the presence or absence of a grape vine was noted for each nest. A sample of the trees >5 inches dbh was taken on each study area and the presence or absence of a grape vine was recorded for each tree in the sample.

A total of 3,799 leaf nests was counted, and on all areas, the percentage of leaf nests with grape vines exceeded the percentage of trees with grape vines. The number of nests associated with grape vines compared with the number expected from the percentage of trees with grape vines was significant ($P < 0.05$) for all tree species except a few in which the trends were the same, but the sample sizes were too small to attain significance.

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Considering all study areas, the hickories, white oak, scarlet oak, and beech appear to be deliberately selected as leaf-nest sites by squirrels.

From average leaf-nest densities found on our study areas, gray squirrels would need 1 to 2 and fox squirrels 2 to 3 grape vines per acre for leaf nest attachment. Leaving this number of grape vines growing does not appear to threaten crop tree growth even on good timber growing sites. Vines left in a few oaks, hickories, or beech will probably be favored by squirrels, but vines left in noncommercial species would also be suitable.

The destruction of grape vines should not be a routine silvicultural practice, especially where wood fiber is just one of the forest products. The emphasis should be on control, not eradication, wherever rampant growth of grape vines is a problem. The cost of removing vines may be justified on high quality hardwood sites where grape vines can severely damage young crop trees following clear-cutting. On lower quality sites, however, the destruction of grape vines is unjustifiable both economically and ecologically.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier

Prairie grasses, mostly switchgrass, indiangrass, and big bluestem, are now predominant species on about 186 of the 1,001 acres of prairie chicken sanctuaries in Jasper County. Prairie grasses are also started, though not dominant, on 29 acres. An additional 143 acres are tentatively scheduled for establishment of prairie grasses because of erodable slopes, waterways, or fields that are not suited to periodic plowing because of size, shape, or aesthetics. Thus, the cover on at least 358 acres (over one-third of the sanctuaries) at Bogota should eventually involve prairie restoration. Redtop, timothy, brome, and legumes probably will continue to be the basic covers on the sanctuaries in the foreseeable future.

Although prairie grasses were shown to be among the poorest cover for nesting prairie chickens regarding (1) density of hatched nests and (2) percentage of success (MWRL 21(11):2-3), there are indications that this situation is changing. Despite the disappointingly low use of prairie chickens of apparently attractive fields of prairie grass, there has been a steady increase in nest success in these grasses--from 25% in 1972 to 75% in 1979 (except in 1978 when success dropped to 33%). In 1979, all hatched nests (3) among 8 nests found on the Yeatter Sanctuary were in fields dominated by prairie grass. On all the sanctuaries in 1979, prairie grass predominated around the bowl of each of the 5 nests found in fields of prairie grass. From 1956 to 1978, prairie grass predominated around the nest bowls of only 64% of the nests found in fields of prairie grass.

The improving use of and increasing success in prairie grass by chickens may be due to gradual improvement in the quality of our prairie grass stands; type of management appears to be a key factor. Nest densities and nest success were compared in 4 categories of prairie management: (1) no disturbance, (2) mowing for weed control (mw), seed (ms), or nesting enhancement (mn), (3) haying, and (4) fresh burn. Although data for all categories are still limited, results for the mowing category (mw, ms, and mn) compared favorably with redtop, timothy, and

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brome--total nest density, hatched nest density (nests/10 acres), and success were 2.2, 1.1, and 50.0% respectively. By contrast, comparable figures for the undisturbed, hayed, and fresh burn categories were 0.9, 0.2, 27.3%; 0.4, 0.1, 25.0%; and 0.0, 0.0, 0%; respectively.

This is an encouraging finding, however, more data are necessary to strengthen the indicated relationship. It would be desirable to add limited grazing to the various approaches to prairie management.

Department of Conservation and Natural History Survey, Cooperating

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Manipulation of Pheasant Habitat

R. E. Warner

Participation in delayed mowing of seeded roadsides has been similar over the last 3 years for the Ford County Management Unit (FCMU) block seeding and for roadsides scattered throughout Ford County that were seeded after roadbed and drainage improvements (MWRL 22(8):1). Cooperators in the roadside management program on both the FCMU and the scattered graded roadsides were individually solicited by the Department of Conservation (DOC).

In recent years, an increasing number of roadsides have been volunteered by farmers for seeding by the DOC. Hypothetically, these volunteer participants would be less likely than solicited cooperators to infract their delayed mowing agreement and mow prior to 1 August. Initial steps were made toward testing this hypothesis in June and July 1979 when 146 miles of managed roadsides controlled by volunteer participants scattered throughout Champaign and Ford counties were monitored for early mowing.

The extent of delayed mowing in 1979 is noted in Table 1 for seeded roadsides controlled by solicited and volunteer cooperators. On the scattered managed roadsides, the percentage of roadsides unmowed by 31 July 1979 was nearly identical among volunteer and solicited participants (Table 1).

On the FCMU, the percentage of roadsides unmowed by 15 July 1979 was comparable to the percentage unmowed on the scattered roadsides. By 31 July 1979, however, approximately 7% more roadsides were mowed on the FCMU than on the other managed roadsides (Table 1).

We plan to continue comparing the mowing behavior of volunteer and solicited cooperators over the next few years.

Table 1. Percent of seeded roadsides controlled by volunteer and solicited participants unmowed through 15 and 31 July 1979.

Type of Cooperator	Location of Seedings	Miles Monitored	Percent of Roadsides Unmowed	
			7-15	7-31
Volunteer	Scattered ¹	146.0	76.3	67.9
Solicited	Scattered ²	82.7	78.7	67.8
Solicited	Block ³	72.5	76.4	60.9

¹ Located in 21 townships in Champaign and Ford counties.

² Located in 12 townships in Ford County.

³ The 20-square-mile Ford County Management Unit.

Ecology and Management of Squirrels

C. M. Nixon,
L. P. Hansen

Within unexploited populations of fox squirrels, the survival of young squirrels is typically quite low; fewer than 30% of those born are still in the population 6 months later. From the number of females known to have nursed young each year, we presume many juvenile squirrels die or disperse shortly after weaning, for they are never captured in livetraps.

We base this conjecture on the fate of those squirrels < 4 months old that we have been able to mark. These squirrels were found to have a significantly reduced survival interval ($P < 0.001$) compared with squirrels first marked at 4-6 months of age. Apparently only those juveniles who are able to compete with the older squirrels for food and den sites remain to breed.

We believe most of these "lost" juveniles emigrate shortly after weaning in response to aggressive interactions with older squirrels. Such dispersal, defined as the distance from birthplace to breeding site, has obvious advantages for the species, despite the high rate of mortality associated with movement into strange areas.

One advantage to a fox squirrel population is the ability to regulate density below carrying capacity, defined here as an evolutionary response to long term average levels in food abundance. Fox squirrels have never been reported to have experienced the large scale migrations so evident in gray squirrels in the 18th and 19th centuries in the midwest. A lack of large scale migrations suggests that fox squirrels are more capable of regulating their abundance than are gray squirrels.

Dispersal also allows fox squirrels to spread their range rapidly as favorable habitats are created and to quickly reinvade areas that may have been depopulated, such as overhunted woodlots. Such a range extension began almost as soon as white settlers began clearing the virgin forests of the midwest. The presettlement range of the fox squirrel was the prairie:forest edge centered in the Mississippi Valley. Yet by 1900, this species had invaded all of Illinois, Indiana, and Ohio and most of lower Michigan. As trees were planted in the short grass prairie of the west, the fox squirrel moved westward and has now reached the foothills of the Rocky Mountains in Colorado.

Responses of Prairie Chickens to Habitat Manipulation

R. L. Westemeier

Last month's newsletter (MWRL 22(11):3-4) discussed prairie restoration and the apparently increasing use of and increasing nest success in prairie grass by prairie chickens on the Bogota Study Area. Also, nest densities and nest success were compared for 4 categories of prairie management: (1) no disturbance, (2) mowing for weed control, seed, or nesting enhancement, (3) haying, and (4) fresh burn. Among these categories, mowing for weed control, seed, or nesting enhancement showed the best results.

Table 2 shows a further breakdown of these data. Prairie chicken nest numbers and nest success are shown for burned and unburned fields dominated by prairie grass according to the nest season after prescribed burning and according to the

management prior to nesting. Nest densities and nest success are highest the 2nd and 5th, or later, nest season after burning, but there is no clear pattern of use between these nest seasons. Burning (i.e. after the 1st nest season after a burn) appears to be better than not burning regardless of the management following a burn. Freshly burned fields and hayed fields of prairie grass clearly result in unattractive cover conditions for nesting prairie chickens.

Table 2. Prairie chicken nest numbers and nest success in burned and unburned fields dominated by prairie grass and according to nest season after burning and management prior to nesting, Bogota, 1967-79.

Nest season after burning, and management prior to nesting	Acres Searched	Nests Found	Nests /10A.	Hatches /10A.	Percent Success
1 (fresh burn)	96	0	0.0	0.0	---
2 undisturbed	14	2	1.4	0.0	0.0
2 mowed	27	8	3.0	1.5	50.0
2 hayed	22	1	0.5	0.0	0.0
3 undisturbed	40	2	0.5	0.5	100.0
3 mowed	16	4	2.5	0.6	25.0
3 hayed	27	2	0.7	0.0	0.0
4 undisturbed	7	1	1.4	0.0	0.0
4 mowed	25	3	1.2	0.0	0.0
4 hayed	4	0	0.0	0.0	---
≥5 undisturbed	15	7	4.7	2.0	42.9
≥5 mowed	11	6	5.5	3.6	66.7
≥5 hayed	13	1	0.8	0.8	100.0
Unburned prairie undisturbed	111	5	0.5	0.2	40.0
mowed	35	3	0.9	0.3	33.3
hayed	20	0	0.0	0.0	---

Ecology and Management of Deer

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

Multiple-use management requires a balance of multiresource information. Illinois can no longer afford to manage her woodlands for single purposes, such as wood fiber or deer, but must strike a balance between contending interests. While conventional forest inventories have provided a wealth of information on timber, they have not provided the species composition, quantity, and spatial arrangement of the lesser vegetation so important to wildlife. For example, dead or rotten trees are useless for timber products, but they are a vital necessity

for the secondary cavity nesting birds. We believe that any future inventory of Illinois' forests must provide multiresource information. We hope to conduct our deer range appraisal so as to provide as much information as possible within the limitations of money and manpower. The objective would be to monitor the successional stages of each significant plant community as these stages affect wildlife. Because man's influence pervades all of these plant communities, the effects of the presence and absence of man's intervention must also be considered.

1. The first part of the paper discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the success of any business and for the protection of the interests of all parties involved. The author argues that without accurate records, it is impossible to make informed decisions or to identify areas for improvement.

2. The second part of the paper focuses on the importance of maintaining accurate records of all transactions. It discusses the various methods that can be used to collect and analyze data, and the importance of ensuring that the data is reliable and valid. The author also discusses the importance of maintaining accurate records of all transactions, and the importance of ensuring that the data is reliable and valid.

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MONTHLY WILDLIFE RESEARCH LETTER

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Illinois Federal Aid Projects W-66-R and W-87-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

January, 1980

Vol. 23, No. 1

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Songbird nest studies were initiated on the Ford County Management Unit (FCMU) in 1976 and have continued to date. Numbers of nests and species were recorded in 1979 on the FCMU for 67 quarter-mile seeded roadside plots (42.4 acres) and 75 plots (35.6 acres) representative of strip and other uncultivated non-agricultural farmland.

Densities of songbird nests in strip and nonagricultural farmland averaged 1.7 per acre in 1979. Nest densities on the roadside vegetation averaged 1.3 per acre in 1979, compared with 1.2, 1.3, and 1.2 per acre in 1976, 1977, and 1978, respectively.

A total of 117 songbird nests were located on the FCMU in 1979; 101 of the 117 (86%) were nests of red-winged blackbirds. Nests of other species included: dickcissel (5 nests), ground-nesting sparrows (4 nests), indigo bunting (3 nests), brown thrasher (1 nest), short-billed marsh wren (1 nest), and 2 unidentified nests.

Systematic attempts to determine rates of hatch and survival of nestlings and fledglings have not been conducted on the FCMU due to the time demands of other field studies. However, preliminary data indicate that slightly less than one-half of the nesting attempts by red-winged blackbirds were successful (hatched) in vegetation searched on the FCMU in 1979.

Ecology and Management of Squirrels - W-66-RC. M. Nixon,
L. P. Hansen

The survival of juvenile fox squirrels born into an unexploited population is quite low; fewer than 30% of those born are still present in the population after 6 months (MWRL 22(12):2).

What is the fate of the surviving juveniles? Most of these squirrels apparently remain close to the area where they were weaned. Fifteen squirrels (5 ♀, 10 ♂) that we marked as juveniles were recaptured a year or more later an average of 86 m (range 0-300 m) from their earlier capture site; this distance is well within the average range of resident squirrels on the study area. A similar pattern was found for gray squirrels in an urban population in Canada and a population inhabiting an extensive old-growth forest in North Carolina.

Why some juvenile fox squirrels remain close to their birthplace and others disperse is not known. One hypothesis is that there are genetic differences between individuals that cause them to be short distance or long distance dispersers. At least 1 investigator feels the only difference between long and short distance dispersers lies in their ability to procure a breeding site. If so, dispersal distance would relate to the level of resistance with which the juvenile meets aggressive action from its mother and any strange squirrels encountered during the early postweaning period. A study of gray squirrels in England found that the breeding female often tolerated her young to settle on a portion of her home range and to use the same feeding and shelter sites.

Our limited data for fox squirrels indicate that at least some juveniles are tolerated by their mother or are aggressive enough to establish a home range within her home range.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R. L. Westemeier

A current objective of this project is to transfer the management of prairie chicken habitat from Survey biologists to Department of Conservation land managers. The most definitive plan for the preservation of prairie chickens in Illinois must await a comprehensive analysis of our 17 years of data on the ecology of this native species. Even then, questions will always arise. However, we now have enough knowledge and experience to diagram a workable plan for habitat management (Fig. 1). By controlling vegetative succession, provision is made for 5 vital activities in the life history of prairie chickens, i.e. nesting, roosting, brooding, feeding, and booming. The plan emphasizes the quality of cover for nesting because this component is most limiting to prairie chickens, due primarily to modern agriculture. The plan is implemented by sharecropping.

The hypothetical 130-acre tract shown in Fig. 1 is subdivided into a 90-acre rotational unit and a 40-acre prairie unit. The 90-acre unit is subdivided into 10-acre fields utilizing a rotation of soybeans, wheat or oats, red clover, and 6 age classes of mixed redtop-timothy. All fields in the 90-acre unit may be allowed to progress into redtop-timothy meadows depending upon the degree of invasion by weeds and woody sprouts. Within 10-12 years, redtop-timothy meadows usually require renovation. Prescribed burning of 1 of the older 10-acre sods may be used to provide booming grounds when a plowed field, wheat field, or new grass seeding is not available. Brooding and feeding cover of high quality is provided by small grains and red clover. Basic nesting and roosting needs are met by redtop-timothy stands at least 1 year of age; management is by seed harvesting by combine in late July and early August. Typically, nesting declines as redtop-timothy sods age and as weed and woody-sprout invasion progresses.

The 40-acre prairie grass unit in Fig. 1 is subdivided into 10-acre fields managed by (1) prescribed burning, (2) haying, (3) mowing for seed, weed control, or nesting enhancement, or (4) no disturbance. The location of the prairie unit was based mainly upon erosion susceptibility. The permanence and heaviness of the rhizomatous root masses of the native grasses essentially eliminate soil erosion. Management of prairie grass by haying and no disturbance may need to be curtailed

In conclusion, the document highlights the critical role of financial record-keeping in the success of any business. By adhering to the guidelines and procedures outlined herein, the company can ensure the accuracy and reliability of its financial information, thereby supporting informed decision-making and long-term growth.

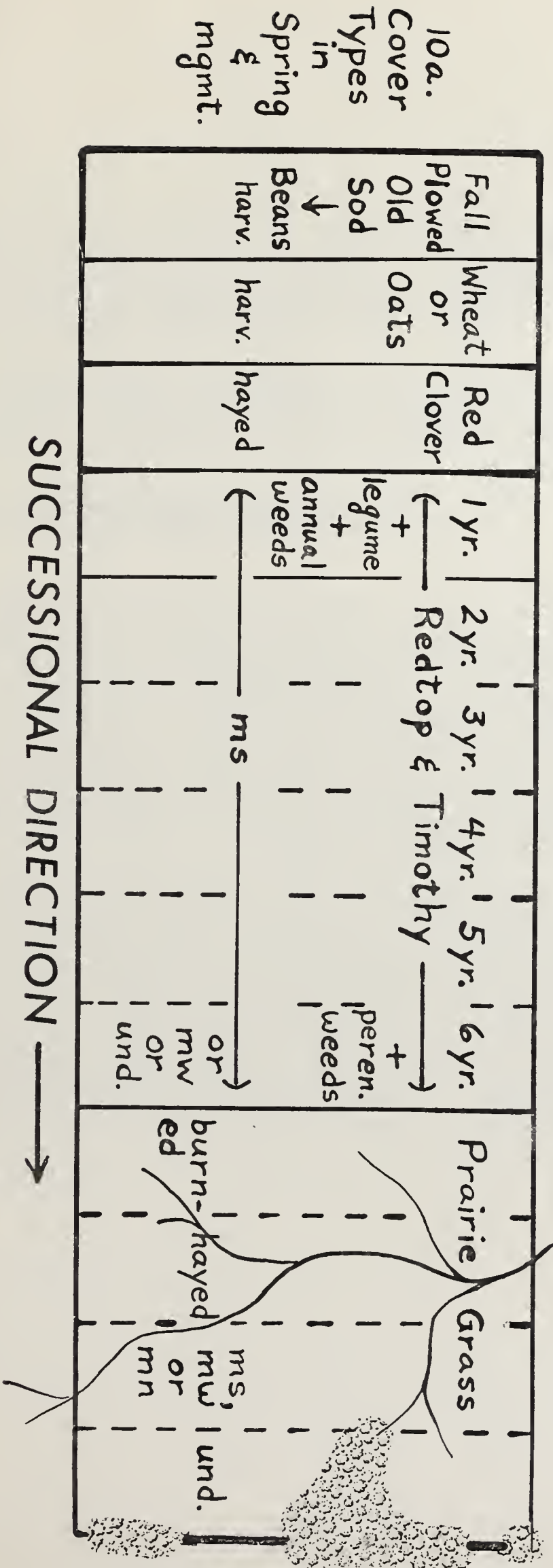
The following table provides a detailed breakdown of the company's financial performance over the last fiscal year. The data is presented in both absolute and percentage terms, allowing for a comprehensive analysis of the company's financial health. The table includes columns for the reporting period, the specific financial metric, and the corresponding values. The data shows a steady increase in revenue and a decrease in expenses, resulting in a significant improvement in the company's overall financial position. The table also includes a section for the company's financial ratios, which provide additional insights into the company's financial stability and performance.

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MANAGEMENT PLAN ON 130 A. FOR PRAIRIE CHICKENS IN ILL.

PC USE --- poor, — fair, █ good, █ high



ms - mowed for seed, mw - mowed for weeds, mn - mowed for nest cover, und - undisturbed

Fig. 1

(MWRL 22(11):3-4; (12):2-3). Mowing for seed, weed control, or nesting enhancement has shown the best results to date. Limited grazing offers the most promising area of research in prairie management. Experiments with fertilizers and herbicides on both redtop-timothy and native grass sods are also needed to maximize quality nest cover on our sanctuaries.

A small amount of woodland is indicated in Fig. 1 to provide prairie chickens with summer fruits, buds, mast, and shade from summer heat. However, constant vigilance is necessary to limit the spread of woody plants.

Ecology and Management of Deer - W-87-R

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

Thus far, the winter of 1979-80 has been mild with little snow cover. Presumably, deer have had no difficulty procuring the forbs, grasses, seeds, and cultivated crops that comprise the bulk of the winter diet for deer in the Midwest. Yet, from our almost immediate success in enticing deer to eat ear corn in Piatt County, we wonder if deer are short of food. Almost no waste grain is available to deer this winter because nearly 100% of the fields in east-central Illinois are fall plowed; most remaining fields are either disced or in pasture. Wheat, or tame hay-alfalfa fields are also scarce throughout central Illinois. Deer are feeding on grasses and forbs in pastures and old fields. Deer appear to be in good condition, but as yet, they have experienced no weather stress.

The effects of current intensified farming on small game populations, particularly pheasants and rabbits, have received much attention, but there has been less concern about the effects of increased row cropping, fall plowing, and more efficient combines on the availability of deer foods. Corn and soybeans are important fall, winter, and spring foods for deer from central Ohio west to the Great Plains. These high energy foods are needed for deer to combat harsh winters where residual cover is scarce and protection from inclement weather is limited. We wonder about the future of deer in many counties in northern Illinois if crop residues are not available each winter. As forested tracts mature, deer are also losing such prime food sources as shrubs and other early successional habitats.

Uncat.

MONTHLY WILDLIFE RESEARCH LETTER

MAR 14 1980

Illinois Federal Aid Projects W-66-R and W-87-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

February, 1980

Vol. 23, No. 2

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Since roadside seedings on the Ford County Management Unit (FCMU) matured in 1970, some farmers have tended to infract their agreement to delay roadside mowing to 1 August each year. Early mowing trends have persisted in recent years, even though cooperators were reminded of the 1 August delayed mowing date in January 1976.

The Department of Conservation (DOC) has expanded efforts to establish undisturbed nest cover along rural rights-of-way in east-central Illinois. The cost-benefit ratio of seedings--determined in part by the percentage of roadside seedings that remain undisturbed for nesting--could be enhanced by the ability to identify the type of farmer least likely to infract a delayed mowing agreement over a period of years.

To profile characteristics of long-term cooperators and learn farmers' attitudes toward roadside management (delayed mowing), a questionnaire was developed and administered to farmers on the FCMU in late summer 1979. Information we hope to gain from analysis of the completed questionnaires includes

1. Characteristics of farmers who tend to adhere to the delayed mowing date regularly over a period of years: farm owner or tenant, or both; priorities in farm operation; level of understanding of roadside management; interest in and knowledge of wildlife; attitude toward hunters.
2. Farmers' perceptions of roadside management: advantages and disadvantages, compatibility with other farm operations, effectiveness of the program for pheasants.

We hope to promote roadside management more effectively by addressing issues of foremost concern to farmers (e.g., weed control, fuel savings) as well as issues of concern to biologists (e.g., phenology of nesting, delayed mowing).

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

Density and stability of tree squirrel populations may be strongly influenced by suitability of habitat. Unfortunately, other than qualitative observations, little quantitative information on habitat selection by fox and gray squirrels exists. As part of a 7-year study of fox squirrels near Danville, an attempt was

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made to evaluate site selection by squirrels within heterogeneous environments. Two study areas, Danville A and B, were grided into 76 and 66, 0.36-ha plots, respectively. One trap was placed randomly in each plot during 2, 10-day trapping sessions each year from 1971 to 1978. Plot use by squirrels was based on number of trap and nest-box captures and was related to 66 environmental variables measured for each plot (Table 1). Multiple regression would seem to be a logical means of evaluating the relationship between squirrel use and habitat characteristics. However, when dealing with a large number of independent variables, many of which are highly correlated, it is possible to lose important variables and to get misleading results. To alleviate this problem we used principal factoring analyses (PFA from SPSS statistical package). PFA transforms an original set of variables into uncorrelated component variables, each of which is composed of a linear arrangement of the original variables in decreasing order of importance. When run on Danville A and B data, 10 new variables were created. For brevity, these variables are described only for Danville A (Table 2). In next month's newsletter we will describe the final step and results of the squirrel habitat analysis.

Table 1. Original Variables

Total density of dominant trees, total density, and basal area of the following trees ($\geq 5''$ dbh).

- black oak
- red oak
- white oak
- shagbark hickory
- tight-bark hickories (mockernut, pignut, and bitternut)
- beech
- black walnut
- basswood
- sugar maple
- sassafras
- crabapple
- ash
- elm
- tulip
- sycamore
- honey locust
- all trees combined

Number of vines

Number of tree species

Mean dbh of dominant trees

Mean dbh of suppressed trees

Density of stems less than 1' tall

Density of stems greater than 1' tall and less than .5" dbh

Density of stems greater than .5" and less than 5" dbh

Number of species greater than 1' and less than .5" dbh

Number of species greater than .5" and less than 5" dbh

Distance to edge

Number of escape dens
Number of nesting dens
Percentage forested
Percentage ravine
Number of species less than 1' tall

Table 2. Transformed Variables (DD = density of dominant, TD = total density, BA = basal area)

-
1. High DD, TD and BA of basswood and sugar maple; large number of tree species; high percentage ravine.
 2. High DD, TD, and BA of black oak, white oak, and all trees combined; large number vines.
 3. High DD and TD for all trees combined; high DD, TD, and BA of shagbark and tight-bark hickories; large number of vines.
 4. High TD and BA of sassafras; high DD, TD, and BA of ash and tulip; high mean dbh of dominants.
 5. High DD of shagbark hickory; high BA of honey locust; high DD, TD, and BA of elm; low percentage forested.
 6. High DD, TD, and BA of red oak and beech; large number of tree species and nesting dens; high percentage of ravine.
 7. High DD and BA of sassafras; high DD, TD, and BA of crabapple; high DD and TD of honeylocust; closer distance to edge; low percentage forested.
 8. High DD, TD, and BA of beech; fewer stems greater than 1' tall; few stems greater than .5" and less than 5" dbh; fewer species less than 1' tall; few species greater than 1' and less than .5" dbh; few species greater than .5" and less than 5" dbh; high percentage ravine.
 9. High DD, TD, and BA of sycamore.
 10. High DD, TD, and BA of black walnut.
-

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R. L. Westemeier

The density of prairie chicken nests (0.85 per 10 acres) on sanctuaries at Bogota in 1979 exceeded nest densities of all other grassland birds except red-winged blackbirds (8.5 nests per 10 acres). Usually, on the sanctuaries, nest density for prairie chickens is less than nest density for eastern meadowlark and dickcissel.

For 13 years (1966-78) the density of prairie chicken nests on the sanctuaries averaged 1.3 nests per 10 acres; hence the nest density of chickens in 1979 was 66% of the mean. However, 8 other birds, the cottontail rabbit, and small mammals (Microtus and Synaptomys) showed nest densities in 1979 that were

1971-1972

1973-1974

1975-1976

1977-1978

1979-1980

1981-1982

1983-1984

1985-1986

1987-1988

1989-1990

1991-1992

1993-1994

1995-1996

1997-1998

1999-2000

2001-2002

much farther below their means than was true for the prairie chickens. No nests (0% of the means) of mourning dove, grasshopper sparrow, short-billed marsh wren, or goldfinch were found in sanctuary grassland in 1979; bobwhite quail, field sparrow, meadowlark, dickcissel, cottontail rabbits, and small mammals were 13%, 14%, 27%, 40%, 30%, and 37% of their mean nest densities, respectively. As in 1978, 2 bird species, the ring-necked pheasant and the endangered upland sandpiper, showed above-average densities of nests--0.26 and 0.08 nest per 10 acres and 186% and 160% of their averages, respectively.

These data suggest that prairie chickens are continuing to do quite well compared with other birds and mammals nesting on the sanctuaries. The current low nest densities for 9 of the 12 grassland birds, particularly resident species and those with limited migratory tendencies, are apparently the result of low breeding populations due to the past 3 severe winters. In addition, quail, doves, meadowlarks, and grasshopper sparrows are showing long-term declines in nest densities that are likely the result of local and regional habitat deterioration.

Population levels of other nesting fauna on the sanctuaries are of concern because of their buffering effect. The buffer species help absorb pressure from predators, particularly during the nesting season. This phenomena was described in previous newsletters (MWRL 20(12):3 and 22(7):2-4).

Ecology and Management of White-tailed Deer - W-87-R

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

In January 1980, 5 female deer (2 adults and 3 fawns) were captured in Allerton Park, Piatt County, Illinois, with a rocket net. A radio transmitter collar was placed on 1 adult; the other 4 deer were fitted with black plastic collars with reflective plastic symbols for visual identification of individuals. The 3 marked fawns have been seen several times with the radio-collared deer, so we are tracking 4 deer with 1 radio.

The radio-collared deer has been located 2-3 times per week since she was captured and released. She was first located 1,275 m northeast of the capture site in heavy cover near a pasture. This movement was probably due to our disturbance. We flushed her 2 other times and she and the fawns went to the same area. Less than 1 week after capture, these 4 deer were found within 250 m of the capture point and appeared to have fed on some of the leftover bait.

The radio-collared doe also frequents a brush-covered ditch surrounded by disked corn stubble about 2,300 m south of the capture site. Large numbers of deer have been seen here, apparently attracted by a wheat field between the park and the ditch.

The greatest distance this doe has moved is 3,100 m west of the capture site and she has been found there only once. We were surprised she moved this far and we are not sure why she did.

We expect to establish more detailed descriptions of home ranges for individual deer after more radio tracking.

individual deer after more radio tracking.

MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R and W-87-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

NATURAL HISTORY SURVEY
APR 8 1980

Urbana, Illinois

March, 1980

Vol. 23, No. 3

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Winter-sex-ratio counts of pheasants are conducted in January-February on study areas in the east-central counties. It is assumed that the ratio of cocks to hens after hunting provides a crude index of the proportion of cocks taken by hunters.

Sex ratios in east-central Illinois during the 1960's averaged approximately 25 cocks per 100 hens; 30.5 cocks per 100 hens were counted following the 1976-77 hunting season (Table 1). The high ratio of cocks to hens from 1978 to 1980, the highest in recent decades (Table 1), reflects effects of severe winter weather and subsequent changes in hunting pressure.

Severe winter storms decimated pheasant populations in east-central Illinois in late January 1977 and again during the winter of 1977-78. Hunters responded to the scarcity of ringnecks with fewer and shorter hunting attempts in the field.

The percentage of cocks harvested in east-central Illinois has traditionally been related to pheasant densities; winter sex ratios for recent years (Table 1) reflects this phenomenon.

Table 1. Winter Sex Ratios (January-February) of Pheasants in East-central Illinois, 1977-1980.¹

Year	Pheasants Counted	Cocks per 100 Hens	Percent Cocks
1977	848	30.5	23.3
1978	597	45.6	31.3
1979	412	61.6	38.1
1980	249	59.6	37.3

¹ Counts were made primarily on study areas in Champaign, Ford, Iroquois, and McLean counties; personnel from the Department of Conservation assisted in sex ratio counts.

THE UNIVERSITY OF CHICAGO
DEPARTMENT OF CHEMISTRY
1155 EAST 58TH STREET
CHICAGO, ILLINOIS 60637

TO: [Name]
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Ecology and Management of Squirrels - W-66-RC. M. Nixon,
L. P. Hansen

In evaluating habitat selection by squirrels, we reduced the number of habitat variables potentially important to gray and fox squirrels into a much smaller number (10) of uncorrelated component variables by principal factoring analysis (MWRL 23(2):2). Factor scores for each of the 10-component variables were assigned to each plot. The number of squirrels captured on each plot (dependent variable) was related to the 10-factor scores for each plot (independent variables) by stepwise multiple regression. The most significant and consistent results were obtained by lumping captures into 2 categories: total fox squirrels and total gray squirrels.

The largest number of fox squirrels were associated with upland habitats having high densities and high basal areas of white oak, black oak, shagbark and tight-bark hickories, and all trees combined. Plots on the edge of the timber with high densities and high basal areas of sassafras, honey locust, and crab apple also held high densities of fox squirrels. The fewest fox squirrels were associated with plots containing high densities and high basal areas of beech and low densities of seedling and sapling trees. Low numbers of fox squirrels were also found in areas with high densities and high basal areas of ash and tulip.

Sites preferred as habitat by gray squirrels were ravines with high densities and high basal areas of beech and sugar maple; edge habitats dominated by sassafras, elm, ash, honey locust, and tulip; and lowland habitats with high densities and high basal areas of black walnut and sycamore. Gray squirrels apparently avoided upland habitats dominated by white and black oaks.

Although both fox and gray squirrels utilize some "edge" habitats, each species was associated with different types of cover. It is not known if these 2 species of squirrels preferred their associated habitat or whether competition forced occupancy of marginal habitat by 1 of the species. From literature on habitat selection by fox and gray squirrels, the association of gray squirrels with ravine habitats in which large trees with numerous cavities are abundant would be expected, as would the proclivity of fox squirrels for upland oak-hickory habitats. It is likely, however, that competition played some role in the evolution of these preferences.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R. L. Westemeier

This report further explains the management plan proposed for the hypothetical sanctuary described in MWRL 23(1):2-3. The 10-acre field size in the plan may appear as unnecessarily intensive management to those who envision prairie chicken habitat as square miles of unbroken prairie grassland. Such a view is still characteristic of prairie chicken habitat in the western great plains. Sanctuary units in Illinois, however, range in size from 17 to 232 acres --not square miles--and these relatively small tracts continue to support higher densities of prairie chickens than are found in any other state.

10/10/1918

Dear Sir,

I have the pleasure to acknowledge the receipt of your letter of the 10th inst. in relation to the above matter. The same has been forwarded to the proper authorities for their consideration. I am, Sir, very respectfully,
Yours truly,
[Signature]

I am, Sir, very respectfully,
Yours truly,
[Signature]

I am, Sir, very respectfully,
Yours truly,
[Signature]

I am, Sir, very respectfully,
Yours truly,
[Signature]

Prairie chicken hens prefer to place their nests near field edges, i.e., sharp edges. Ten acres is a practical field size to provide edge. Where edge is indistinct, as between meadows of sods of different ages, mowed or disked firelanes, or both, can provide sharp edge.

Ten-acre fields are ideal for booming grounds. The largest and most stable booming grounds at Bogota have been maintained on fields about 10 acres in size. Typically, such booming grounds attract 20 to 40 cocks. In 1972 a 10-acre field of soybean stubble surrounded by nest cover contained 65 cocks (the largest on record) throughout the breeding season. Conversely, fields of 5 acres or less, though otherwise suitable (bare ground or short sparse cover and surrounded by nest cover), generally do not attract even small numbers of cocks.

The 10-acre field size provides sufficient incentive for sharecropping. Such a unit is also convenient for bookkeeping and for determining amounts of seed and fertilizer needed in routine management.

Ecology and Management of White-tailed Deer - W-87-R

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

This report summarizes the deer captures made during the winter of 1980. All captures were made by shooting a rocket net over deer feeding on a bait pile of corn, apples, and salt blocks. Two crew members watched from a blind and fired the rockets when the deer were in positions.

Most captures were made on, or adjacent to, Robert Allerton Park, approximately 1,500 acres owned by the University of Illinois and located 4 miles southwest of Monticello, Piatt County, Illinois. One capture was made 2 miles northeast of Urbana, Champaign County, Illinois, on 80 acres also owned by the University and used for plant and animal ecology studies.

From a total of 9 successful captures, 23 deer were marked--1 adult male, 5 adult females, 10 male fawns, and 7 female fawns. The deer were marked as follows: radio-transmitter collars on 3 adult females and 2 female fawns, thermoplastic collars bearing reflective symbols on all other females, a special expandable collar with a reflective symbol on the adult male, and vinyl-coated nylon streamers attached to each ear of the male fawns. Collars and ear streamers were color coded to correspond to specific capture sites. All deer were marked with numbered metal ear tags for identification upon death or recapture.

One male fawn was recaptured at the same bait site 6 weeks after the original capture. His ears had healed well after the ear streamers were attached.

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MAY 5 1980

MONTHLY WILDLIFE RESEARCH LETTER

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Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

April, 1980

Vol. 23, No. 4

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Pheasant nests have been counted annually on Ford County Management Unit (FCMU) since 1973. Numbers of nests have been recorded for 68 seeded roadside plots .25 mile in length; roadside plots were randomly selected for searching after dividing the FCMU into 4, 4-square-mile blocks.

Over the 7 years of nest searches, pheasant numbers and numbers of nests found on roadsides have declined as hay and small-grain fields have been replaced by row crops. An important question for roadside management is: to what extent do pheasants nest on roadsides where there are no nearby hay or small-grain fields, or both?

Preliminary analysis shows that frequency of nesting on roadside plots has not been different ($P > .20$) among the 4 blocks from which roadsides were randomly selected, or among road types adjacent to seeded vegetation ($P > .80$). The type of road--dirt, gravel, or blacktop--is assumed to be a crude indicator of vehicular traffic.

Encoding of data is nearly complete and will facilitate multivariant analysis of variance tests for differences in frequency of nesting related to distance from the roadside plots to the nearest hayfield, small-grain field, and farmstead. Additional covariants in the analysis will be width of roadside plot and proximity of each plot to the roadside management area.

These analyses may be important in selecting roadside management areas.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

Although social behavior has been implicated as a density regulating mechanism in numerous rodent populations, its role in regulating the abundance of fox squirrels is largely unknown. The low and constant densities at which fox squirrels are generally found, however, suggest that some intrinsic mechanism may act to maintain stable populations.

To gain insight into the social behavior of fox squirrels, we evaluated the dispersion of animals in 2 woodlots near Danville. From livetrapping data we calculated an index of home-range overlap within and among 4 sex-age categories: juveniles, adult males, breeding females, and nonbreeding adult females.

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1. *Chlorophyll a* (Chl *a*)

[illegible]

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1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.

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Probability of occurrence for each of the 4 categories was based on total trap captures. These values were used in a polynomial expansion to calculate expected frequencies for all possible combinations of the 4 categories. Chi square analyses indicated that these comparisons were significant in all cases except during autumn on Danville B when sample sizes were low.

In general, home ranges of females overlap less than expected with other breeding and nonbreeding females whereas adult males overlap more than expected with other adult males and nonbreeding females. Females apparently tend to avoid other females whereas adult males do not avoid other males. Nest box and leaf nest data support this phenomenon; 2 females are virtually never captured in a nest box or leaf nest whereas 2 males are commonly captured together.

Although definite conclusions about social behavior in fox squirrels cannot be drawn from this analysis, female spacing in the habitat may play an important role in density regulation. Further study is warranted because the introduction of additional life-supporting elements into a squirrel population, such as nest boxes or supplemental food, may be useless if intrinsic social factors exclude excess individuals from the population.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R. L. Westemeier

Prairie chicken populations near Bogota (Jasper Co.), Farina, Kinmundy (both Marion Co.), Mt. Erie (Wayne Co.), and Hoyleton (Washington Co.) were censused this spring (1980). These areas have been censused annually for 18, 18, 17, 18, and 12 years, respectively. As in past years, booming ground surveys at Bogota were supplemented with observations by visitors in blinds almost daily from 25 March through 29 April.

Counts in 1980 totaled 167 cocks, up 55% from the 112 cocks censused on the 5 areas in 1979. Assuming a 50:50 sex ratio, there were 334 native prairie chickens in Illinois in the spring of 1980--a gain of over 100 birds since last spring.

The managed areas, those with sanctuaries for nesting (Bogota, Farina, and Kinmundy), showed an increase of 44% over last spring. The Bogota flock increased from 68 cocks in 1979 to 92 cocks in 1980, up 35%; the 1980 count is 98% of the long-term mean. The flock at Farina increased from 22 cocks in 1979 to 38 cocks in 1980, up 73% and 126% of the long-term mean. Near Kinmundy, the flock increased from 18 cocks to 26 cocks, up 44% but 177% of the long-term mean; this flock was down to only 6 cocks in 1971. A combination of these 2 flocks in Marion County this spring (64 cocks) represents the highest population level on record.

Although unmanaged flocks at Mt. Erie and Hoyleton remain at precariously low levels, they showed larger percentage gains than flocks on the managed areas. The birds at Mt. Erie were not located in 1979 despite thorough searches on 2 excellent mornings. Noise from oil wells hinders censusing of this Wayne County flock. By intensive checking at Mt. Erie this spring (1980), 4 cocks and 3 hens were observed in and near a 50-acre redtop-timothy seed meadow. Fortunately,

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due to the current high market value of redtop and timothy seed and the dismal outlook for soybean and corn prices, the private landowner plans to leave his meadow intact this year. The meadow provides the best remaining nest cover in the area.

The tenacity of the prairie chickens at Hoyleton continues to "boggle the mind." Despite a landscape that may be described as a "biological desert," the count at Hoyleton has ranged from 2 to 11 cocks and averaged 6.1 cocks over the past 12 springs. The count increased from 4 males in 1979 to 7 males this spring. There should be no prairie chickens at Hoyleton--yet they persist. Because Hoyleton obviously has unique characteristics that allow survival of this flock, this area appears to have potential comparable to Yeatter-Field-McGraw at Bogota--the area which has supported the highest density of prairie chickens in North America. A minimum of secure nest cover, perhaps as little as 40 acres, might preserve the prairie chickens at Hoyleton indefinitely.

Ecology and Management of White-tailed Deer - W-87-R

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

Five deer captured in the vicinity of Allerton Park, Piatt County, Illinois, were marked with radio transmitter collars. Four of the 5 transmitters are still functioning and the animals wearing them are located 3-4 times per week with a vehicle-mounted antenna and receiver. Two females, 1 adult and 1 fawn, are currently in or around the park and each maintains a consistent home range of less than 1 square mile. Detailed home ranges will be determined later.

The other 2 radio-collared deer, both adult females, have dispersed greater distances. One doe, captured 3 March 1980, moved 2 miles southwest of the capture site, 6 days later she crossed Sangamon River to an area 1 mile northeast of the capture site, and after 13 March she was found 4 miles further up river. She was located 22 March approximately 12 miles northeast of the capture point where she has remained covering a consistent home range similar in size to that of the radio-monitored deer still near Allerton Park.

The other dispersing doe was captured 9 March. Through 22 April she maintained a small home range; only once was she found more than 1 mile from the capture site. On 25 April, however, she was found approximately 5 miles northeast of the capture site. As there is little good deer habitat in that area, we expect her to move again.

We will continue to monitor daily movements of these deer through summer and into next winter, provided the transmitters continue to function.

The first part of the report deals with the general situation of the country. It is a very interesting and informative study of the country's development. The second part of the report deals with the specific details of the country's development. It is a very detailed and thorough study of the country's development. The third part of the report deals with the specific details of the country's development. It is a very detailed and thorough study of the country's development.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R and W-87-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

NATURAL HISTORY SURVEY

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Urbana, Illinois

May, 1980

Vol. 23, No. 5

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

The design for analyzing the frequency of nesting by pheasants on randomly selected roadside plots on the Ford County Management Unit (FCMU) from 1973-79 was introduced last month (MWRL 23(4):1). Factors which partly explain variation in the number of nests per plot per year were identified by multivariate analysis of variance (ANOVA) tests.

Year and distance from plots to the nearest hay and small grain (oats or wheat) fields were significant variables ($P \leq .05$) in the ANOVA model (Table 1). Distance of both hay and small grains correlated negatively with the number of nests per plot (small grains, $r = -.25$; hay, $r = -.13$) and are of little value in predicting nest densities on roadside plots. Multiple regression models show that the hay, small grain, and farmstead variables together explain only 7% of the variation among plots in the numbers of nests.

In the last decade, the reduction of hay and small grain fields on the FCMU have impaired relative rates of survival and reproductive success of pheasants; the resulting decline in pheasant abundance largely explains the year-to-year decline in numbers of nests per plot. The year variable (Table 1) reflects this phenomenon.

Scatter plots in conjunction with the ANOVA model (Table 1) indicate that the probability a pheasant(s) will nest in a given roadside plot increases as the distance from the nearest hay or small grain field decreases. This is particularly evident for plots adjacent to a hay or small grain field; these plots tend to have greater-than-average numbers of nests for any given year.

Table 1. Independent variables considered in a multivariate ANOVA of nesting by pheasants on seeded roadside plots on the FCMU. The dependent variable = number of nests per plot per year ($n = 504$).

Source of Variation	F- value	Significance
COVARIATES: ^a		
Hay	3.9	.049
Small Grains	40.9	.001
Farmstead	0.8	.370

Table 1 - continued

Table 1. Continued - page 2.

MAIN EFFECTS:^b

Area	1.6	.182
Road	0.4	.645
Location ^c	1.3	.257
Year	47.2	.001

^aCovariates were measured as distance (meters) from the plot to the nearest farmstead, hay, and small grain field.

^bArea = quadrant of FCMU; Road = dirt, gravel, or blacktop; Location = plot located within the central 4 sections or on the outer perimeter of sections; Year = 1973 to 1979.

^cLocation was considered a potential indicator of differences in nest densities related to dispersal of pheasants on or off the FCMU.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

Trap-capture overlap among and within sex and age classes of fox squirrels on the Danville study areas was discussed last month (MWRL 23(4):1-2). Another method of looking at squirrel distribution within a habitat is to compare the variance to mean ratio of capture rates per plot with that expected if the animals were randomly, evenly, or aggregately distributed. Random, even, and aggregate dispersion would have variance to mean ratios of 1, less than 1, and greater than 1, respectively.

The results of this analysis were similar to those reported for trap overlap. Adult female fox squirrels were evenly dispersed (coefficient of dispersion [C.D.] = .82) whereas adult males were randomly to aggregately dispersed (C.D. = 1.06). When all sex and age classes were combined, we found that fox squirrels tended to be evenly dispersed (C.D. = 0.88). Similar analyses for gray squirrels indicated that gray squirrel distribution was much more clumped (C.D. = 1.46) than that of fox squirrels. Gray squirrels apparently are attracted to each other or to specific, perhaps limited, habitat whereas fox squirrels, especially females, tend to avoid one another. Some researchers have indicated that social systems in fox and gray squirrels do not differ. This analysis, however, suggests that some behavioral differences exist and these differences could influence maximum potential densities. The gregariousness of gray squirrels might allow higher densities than fox squirrels, which tend to

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disperse evenly throughout suitable habitat. Studies by other researchers indicate that gray squirrels often occur at higher densities than fox squirrels. As indicated in last month's newsletter, the density regulatory effect of the social system in fox squirrels may preclude certain management efforts. Such efforts would more likely produce positive results in gray squirrel populations.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R.L. Westemeier

Prairie chicken populations in Illinois showed an overall gain of 55% between the springs of 1979 and 1980 (MWRL 23(4):2-3). A popular rationale for this increase is that the unusually mild winter of 1979-80 resulted in minimal winter mortality of prairie chickens. This view assumes that weather-related winter mortality is highly significant in the population ecology of remnant flocks of Illinois prairie chickens. Analysis of spring and fall census data for booming grounds on the Bogota Study Area does not support this hypothesis.

Since 1966, booming grounds at Bogota have been censused approximately biweekly from October through December, weekly from January through late March, and almost daily from late March through late April. Cock counts on booming grounds usually peak in spring during the first week of April and in fall, between late October and mid-December.

Since 1966, correlation of spring counts (dependent variable) with the previous fall counts (independent variable) has been highly significant ($r = 0.979$, $P < 0.001$). Thus, the spring population at Bogota since 1966 has been closely dependent on the fall population; 96% of the variation in spring numbers has been associated with fall numbers. Little variation in the spring populations could possibly relate to differential winter mortality; i.e., winter storm related mortality has not been a significant factor for prairie chickens at Bogota.

By contrast, the relationship of fall counts (dependent variable) with the previous spring counts (independent variable) indicates a lower correlation coefficient of $r = 0.814$ ($P < 0.001$). Thus, whereas 66% of the variation in fall numbers relates to variation in spring numbers, approximately one-third of the fluctuation in fall numbers of prairie chickens is unexplained and relates to events of the nesting and brooding periods, or both.

Over the past 14 years at Bogota, changes in prairie chicken abundance have primarily reflected variations in net productivity. Once again, the implication is that quality nest-brood habitat must continue to be emphasized in managing prairie chickens in Illinois.

Apparently, winter food and cover have been adequate at Bogota even during the severe winters of 1976-77, 77-78, and 78-79. Provision of additional winter food and cover has never been seriously considered in our management program. However, the above correlations do not negate the possibility that winter food patches, such as unharvested corn or soybeans, strategically located, might promote a more favorable dispersal of the Bogota flock. Specifically, the birds at Bogota continue to concentrate on the Yeatter-Field-McGraw sanctuary unit. A better distribution of the chickens in winter might lead to higher net productivity.

Basically, the greater prairie chicken must be considered a winter-hardy native. They will burrow in snow to roost and eat the buds on trees when "the going gets tough" in winter. Severe winters that can cause heavy losses among such species as the bobwhite and ringneck are not a serious problem to prairie chickens in Illinois.

Ecology and Management of White-tailed Deer - W-87-R

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

Five female, white-tailed deer were captured 15 January 1980 in Allerton Park, Piatt County, Illinois. One of the 5 was fitted with a radio transmitter collar and the others were marked with visual identification collars. The 3 fawns and the adult wearing the transmitter have remained together since capture; the other adult has occasionally left the group and is currently separated from it.

Radiotelemetry and visual observation were used to record the day and night locations of the radio-monitored animal to determine its daily range, and, coincidentally, the range of the 3 fawns.

All known locations of the radio-monitored deer were plotted on enlarged aerial photos marked with a grid of squares, each representing approximately 1 hectare. Lines connecting the outermost locations formed a polygon which reasonably represents the daily range of this animal for 10 February through 25 April. Locations far outside this major area were not included since the deer was found at them only once each.

The area enclosed by the polygon is approximately 91 hectares (224 acres) with a major axis of 3,220 m (2 miles) oriented in a north-south direction. The area is 760 m (0.5 mile) at its widest point, 152 m (0.1 mile) at its narrowest, and has an average width of 330 m (0.2 mile). This long narrow shape is due to a winter wheat field which provides a travel lane from the south edge of the park to a timbered creek bed.

Table 2 shows the breakdown of the different habitat types found within the home range of this animal.

During the day, the radio-monitored deer was usually in one of the successional hardwoods habitats or in the bottomland hardwoods along the creek. At night she spent much time in corn stubble or wheat and often bedded in these fields for part of the night. By 21 April, when vegetation had sprouted in the timber, this deer--and other deer--were seldom seen in the wheat field.

The radio-monitored deer was last known to be on her winter range 25 April. On 6 May she was located by aerial tracking in a 7-acre, oak-hickory woodlot 3 miles north and 1 mile west of Atwood, Piatt County, Illinois. She had moved 12 miles southeast of her winter range on the Sangamon River drainage to the Lake Fork of the Kaskaskia River drainage.

We will continue to monitor this deer for any further dispersal-type movements.

Table 2. Percentages of habitat types within the winter range of an adult, female, white-tailed deer.

Habitat Type	Area		Percent of Total Range
	Hectares	Acres	
Corn stubble (disked, plowed, or untilled)	52.7	130.1	58.0
Winter wheat	12.2	30.2	13.5
Successional hardwoods (black locust), pole-sawlog size; multiflora rose, gooseberry understory	9.5	23.5	10.5
Successional hardwoods (mixed), seedling-sapling size; hawthorn, wild crab, multiflora rose understory	3.1	7.6	3.4
Upland hardwoods (oak-hickory); hawthorn, wild crab, mixed hardwoods understory	4.5	11.2	5.0
Bottomland hardwoods (mixed); immature bottomland hardwoods, forbs understory	2.8	6.9	3.1
Grass, forbs	3.8	9.4	4.2
Norway spruce; grass, forbs understory (roadside)	0.9	2.1	0.9
Red pine; grass, forbs understory	0.6	1.5	0.7
Osage orange hedge	0.6	1.5	0.7

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Illinois Federal Aid Projects W-66-R and W-87-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

June, 1980

Vol. 23, No. 6

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Spring pheasant censuses were conducted on 5 areas in 1980; biologists from the Department of Conservation assisted with May cock call counts. The audio censuses have been conducted on all 5 areas--Sibley Study Area (SSA), Ford County Management Unit (FCMU), Anchor Township (McLean County), Harwood Township (Champaign County), and Prairie Green Township (Iroquois County)--since 1976.

Trends in cock call counts on the 5 areas are listed in Table 1. The trends in cock call counts from 1979 through 1980 suggest some progress toward a recovery from winter storm-related mortality (1977-78) by pheasant populations in east-central Illinois. In 1980 the number of cock calls increased on all areas; however, Prairie Green increased only 2.5% (Table 1). This increase, averaged for all 5 areas, was 38.5%.

Spring visual counts on the FCMU and SSA, which are conducted along standardized routes, confirmed the trends indicated by cock calls. On the SSA, 16.5 cocks were observed per 100 miles of driving in 1980 compared with 5.3 in 1979, 6.4 in 1978, 22.8 in 1977, and 117.5 in 1976. On the FCMU, 23.1 cocks were observed per 100 miles in 1980 compared with 10.8 in 1979, 6.9 in 1978, 30.8 in 1977, and 123.5 in 1976.

Pheasant populations were decimated by storms in January 1977 and during the winter of 1977-78. Thus cock calls in 1977 and 1978 show 2 successive years of decline (Table 1). The data in Table 1 suggest that pheasant populations on the study areas have thus far recovered to the approximate level of abundance noted in the spring of 1977, following the first episode of storm-related mortalities.

Table 1. Cock calls per 2-minute stop on 5 areas of investigation in east-central Illinois censused in May 1976-80. Numbers represent averages of the 5 highest counts recorded per stop per year.

Area	1976	1977	1978	1979 ¹	1980	Percent Increase 79-80
SSA	12.8	2.8	2.0	2.8	3.9	39.3
FCMU	22.9	7.8	6.4	6.1	11.4	86.9

Table 1 - continued.

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Anchor	19.9	5.7	4.2	2.5	3.0	20.0
Harwood	11.8	7.1	6.1	5.5	7.9	43.6
Prairie Green	28.4	9.2	3.0	8.0	8.2	2.5
Mean	19.2	6.5	4.3	5.0	6.9	38.5

¹Due to unusually poor counting conditions, the 3 highest counts per stop were used in computing the average number of cock calls per area.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

Many researchers have suggested that a close tie exists between fall mast supplies and the demography of tree squirrels, although most evidence for this is anecdotal. Fox squirrels heavily utilize mast during autumn and cache seeds for use during other times of the year. Since mast abundance fluctuates tremendously from year to year, it might be expected that a demographic response to poor or good food supplies would have evolved in fox squirrels.

As part of the nest box study near Danville (see previous newsletters), we measured mast production each fall on the 2 study sites. Production of sound seed (Kg/ha) was calculated for each species appearing in the mast samplers. We trapped squirrels concurrently with mast sampling.

Densities of fox squirrels, reproductive rates, and survival rates differed considerably among years; however, correlations between each of these demographic parameters and mast production (black oak, white oak, hickories, and total mast) were not significant ($p > .05$). The 2 study plots were vegetationally diverse and a complete mast failure never occurred during the study period. Apparently fox squirrels on the study plots were never seriously stressed by food shortages. This species is an opportunistic feeder and utilizes the most available food source. We do not say that mast is not important. In less diverse woodlots or when late spring frost seriously reduces total mast abundance, we might expect demographic consequences. Such consequences have been documented for gray squirrels. During an average year, however, fox squirrels do not seem to be affected by the abundance or shortage of mast.

In next month's newsletter we will discuss other factors that may influence reproduction and survival in fox squirrels.

Responses of Prairie Chickens to Habitat Manipulation-W-66-R

R.L. Westemeier

Ninety-three percent of Illinois' remaining prairie chickens are located either on or near the nest sanctuaries--now totaling 1,001 acres in Jasper County and 640 acres in Marion County. Because of this limited acreage and the dim likelihood of adding much additional land to the sanctuary system, each of the 12 sanctuary units should be developed to its fullest potential. The goal

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is to maintain a maximum of quality nest habitat on each sanctuary unit and thereby obtain breeding populations dispersed approximately in proportion to available habitat. This goal has not been attained at Bogota.

Although the prairie chicken population on the Bogota Study Area increased 35% between the springs of 1979 and 1980 (MWRL 23(4):2-3), the flock remains concentrated. This spring (1980), 65% of both the cocks and hens were observed on 23% of the sanctuary acreage at Bogota--the booming grounds on the Yeatter-Field-McGraw sanctuary unit. From 1963 through 1979 an average of 60% of the cocks and 45% of the hens observed during booming season were located in this area. Nest success was high (50-100% hatched) throughout the 10-year period of 1963-72 on the Yeatter-Field-McGraw unit despite high densities of birds and nests but since 1973 has ranged from 24 to 56%.

The 160-acre Donnelley-Walters unit, 16% of the sanctuary acreage at Bogota, has supported an average of 20% of the cocks and 22% of the hens observed during the booming season from 1967 through 1979; respective figures for 1980 were 22% of the cocks and 24% of the hens. Nest success has averaged 55%.

Proportionately lower numbers of prairie chickens and nests have been the rule on the more peripheral sanctuaries and often, but not always, higher success has resulted. Thus, lower densities appear to be partly compensated by higher nest success. However, 2 tracts, the 57-acre Mark and 110-acre Galbreath sanctuaries, have not supported booming grounds or any known nesting for the past 4 or 5 years. Also, the 140-acre McCormick and 222-acre Otis-Fuson sanctuaries remain much below their potential for prairie chickens. Woody cover reduction, control of free-ranging dogs and other predators, control of pheasants, and upgrading fields designated for prairie restoration are some of the more important management activities to deal with in Jasper County.

In Marion County this spring, all 5 sanctuary units were supporting booming grounds either within or near the sanctuary boundaries. On each, the ratio of acreage to chicken cocks was in better balance than in Jasper County. Woody cover reduction, cleanup of old buildings and junk, and prairie restoration are some of the more important management activities needed to upgrade the sanctuaries in Marion County.

Ecology and Management of White-tailed Deer - W-87-R

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

The winter range of a radio-monitored, adult, female deer, and the methods for determining range were described last month (MWRL 23(5):4). The present report describes the winter range of a doe captured as an 8-month-old fawn 27 February 1980.

The young doe was captured in a pasture 1,240 m (.75 mile) east of the east boundary of Allerton Park. From 29 February to 24 April, this doe usually remained in the area around the capture site--referred to hereafter as the winter range. She was usually seen with an unmarked fawn of unknown sex and an unmarked adult female.

The winter range totalled 78.6 hectares (194.1 acres). Its major axis was 1,879 m (1.2 miles) long and was oriented in an east-west direction roughly parallel to the Sangamon River. The minor axis was 905 m (0.6 mile) but the area tapered off and became very narrow (100 m) at the west end.

Habitat types found within the winter range and the proportions in which they occurred are listed in Table 2.

Occasionally the young doe moved from 850 to 1,500 m (0.4 to 0.9 mile) outside the winter range, but she did not remain at any of these locations for more than 1 day. During the day she was nearly always found in hawthorn-wild crab brush. Within the hour before sunset she was often seen entering the pasture or alfalfa-timothy field where she, and several other deer, grazed heavily and frequently bedded for part of the night.

The daily movements of this deer have shifted to a different area and will be detailed in the next report.

Table 2. Proportions of habitat types within the winter range of a white tail female fawn.

Habitat Type	Area		Percent of Total Range
	Hectares	Acres	
Upland hardwoods (oak-hickory), pole-sawlog size; seedling-sapling size, mixed successional and upland hardwoods understory	14.9	36.8	19.0
Upland hardwoods (oak-hickory), pole-sawlog size; hawthorn, wild crab, raspberry, rose, gooseberry understory	1.65	4.1	2.1
Upland hardwoods (mixed mesophytic), pole-sawlog size; seedling-sapling size, mixed successional and upland hardwoods understory	2.85	7.0	3.6
Upland hardwoods (mixed mesophytic), pole-sawlog size; hawthorn, wild crab, raspberry, rose, gooseberry understory	0.9	2.2	1.1
Bottomland hardwoods (sycamore, silver maple, elm), pole-sawlog size; seedling-sapling size, bottomland hardwoods understory	3.8	9.4	4.8
Bottomland hardwoods (silver maple), pole-sawlog size; seasonally flooded, no understory	4.5	11.1	5.7
Brushland (hawthorn, wild crab), seedling-sapling size; raspberry, rose, gooseberry understory	23.6	58.3	30.0
Osage orange, in grass-forbs pasture	0.3	0.7	0.4

Table 2 - continued.

1. The first part of the report discusses the general situation of the country and the progress of the work in the various departments. It also mentions the results of the recent elections and the state of the economy.

2. The second part of the report deals with the internal affairs of the country, including the administration of justice, the education system, and the health services. It also mentions the progress of the various public works projects.

3. The third part of the report discusses the external relations of the country, including the relations with the neighboring countries and the international community. It also mentions the progress of the various diplomatic missions.

4. The fourth part of the report discusses the progress of the various public works projects, including the construction of roads, bridges, and railways. It also mentions the progress of the various social welfare projects.

5. The fifth part of the report discusses the progress of the various educational projects, including the construction of schools and the improvement of the curriculum. It also mentions the progress of the various research projects.

6. The sixth part of the report discusses the progress of the various health projects, including the construction of hospitals and the improvement of the medical services. It also mentions the progress of the various public health projects.

7. The seventh part of the report discusses the progress of the various social welfare projects, including the construction of housing and the improvement of the social services. It also mentions the progress of the various social work projects.

8. The eighth part of the report discusses the progress of the various public works projects, including the construction of roads, bridges, and railways. It also mentions the progress of the various social welfare projects.

9. The ninth part of the report discusses the progress of the various educational projects, including the construction of schools and the improvement of the curriculum. It also mentions the progress of the various research projects.

10. The tenth part of the report discusses the progress of the various health projects, including the construction of hospitals and the improvement of the medical services. It also mentions the progress of the various public health projects.

Alfalfa, timothy	16.5	40.8	21.0
Grass, forbs	3.0	7.4	3.8
Grass, forbs (pastured)	2.0	4.9	2.5
Corn stubble (plowed)	4.0	9.9	5.1
Water	0.6	1.5	0.8

MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

NATURAL HISTORY SURVEY

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Urbana, Illinois

July, 1980

Vol. 23, No. 7

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Pheasant investigations under Research Project W-66-R and the preceeding project, W-30-R, are unique among pheasant research endeavors in their longevity and intensity. For example, monitoring of certain parameters of ringneck populations and agricultural land use in east-central Illinois has spanned over 3 decades. Also, various aspects of pheasant reproduction, survival, and management have been investigated for shorter periods.

A long-time problem for project leaders has been lack of time for in-depth analyses of data and preparation of manuscripts when studies were completed. Thus, much information remains unpublished in project files. Herein lies a challenge for this project.

Recently, a step toward a more comprehensive analysis-publication effort was taken. Stan Etter, leader of the pheasant ecology project under W-66-R from 1964 to 1971, has returned on a part-time, hourly basis. Stan farms near Forrest, Illinois; during the winter he will assist with the analysis of data and publication of manuscripts.

This spring, Stan analyzed survival characteristics of pheasant populations on the Sibley Study Area. The survival data were generated during an intensive capture, marking, and observation study in the 1960's. Preparation of a manuscript summarizing the findings of the survival study will begin next fall.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

The influence or lack of influence of tree mast on the demography of fox squirrels during a 7-year study near Danville was discussed last month (MWRL 23 (6):2). Parameters such as percentage of adult females breeding, percentage of yearling females breeding, and survival of young and adults exhibited considerable seasonal and annual variation that we could not attribute to food abundance. Other researchers, mostly in the laboratory, have demonstrated that some rodent species may exhibit intrinsic controls of certain demographic factors. Results of such studies show that in general as population densities increase, breeding and survival rates increase. We looked for similar relationships in fox squirrels in the Danville data by correlating breeding and survival values with the number of adult males, number of adult females, and total number of fox squirrels.

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The reproductive intensities of yearling and adult females were positively correlated ($r = .68$, $n = 7$) and both were negatively related with the number of adults and total number of fox squirrels the previous trapping period (Table 1). Unfortunately, the small sample sizes hamper the statistical analyses, but of all comparisons made, number of fox squirrels the previous season accounted for the largest amount of seasonal and annual variation in reproduction.

Juvenile survival (birth to 6 months) and adult male survival were not influenced by the number of adult males or females or the total number of fox squirrels (Table 2). Adult female survival, however, may have been negatively affected by adult numbers, especially males (Table 2). These data suggest that male and female survival may be regulated by different factors. Although not conclusive, these results indicate that intrinsic factors may play some role in population regulation of fox squirrels. Implications of this regulatory system to management of fox squirrels may be important, especially in programs where artificial means of increasing harvestable animals on an area are being considered.

Table 1. Correlation matrix comparing reproductive intensity (percent breeding with arc sine transformation) and numbers of fox squirrels present the previous trapping period.

	Reproductive Intensity (% Lactating)	
	Yearling Female	Adult Female
Number Adult Males	-0.96 ($n = 6$)	-0.499 ($n = 12$)
Number Adult Females	-0.751 ($n = 6$)	-0.544 ($n = 12$)
Total Squirrels	-0.799 ($n = 7$)	-0.522 ($n = 12$)

Table 2. Correlation matrix comparing percent survival (arc sine transformation) and number of fox squirrels present ($n = 12$).

	Survival		
	Adult Male	Adult Female	Juvenile
Number Adult Males	-0.295	-0.592	-0.168
Number Adult Females	-0.15	-0.448	-0.148
Total Squirrels	-0.216	-0.225	-0.021

1. The first part of the report is a general introduction to the subject of the study. It discusses the importance of the problem and the objectives of the research. It also mentions the scope of the study and the limitations of the data.

2. The second part of the report is a detailed description of the methods used in the study. It includes a description of the sample, the instruments used, and the procedures followed. It also discusses the statistical methods used to analyze the data.

3. The third part of the report is a discussion of the results of the study. It presents the findings of the research and discusses their implications for the field of study.

4. The fourth part of the report is a conclusion. It summarizes the main findings of the study and provides recommendations for further research.

5. The fifth part of the report is a list of references. It includes a list of all the sources used in the study.

6. The sixth part of the report is an appendix. It contains supplementary material that is not included in the main body of the report.

7. The seventh part of the report is a glossary. It defines the key terms used in the study.

8. The eighth part of the report is a list of tables. It includes a list of all the tables used in the study.

9. The ninth part of the report is a list of figures. It includes a list of all the figures used in the study.

10. The tenth part of the report is a list of appendices. It includes a list of all the appendices used in the study.

11. The eleventh part of the report is a list of references. It includes a list of all the sources used in the study.

12. The twelfth part of the report is a list of tables. It includes a list of all the tables used in the study.

13. The thirteenth part of the report is a list of figures. It includes a list of all the figures used in the study.

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16. The sixteenth part of the report is a list of tables. It includes a list of all the tables used in the study.

17. The seventeenth part of the report is a list of figures. It includes a list of all the figures used in the study.

18. The eighteenth part of the report is a list of appendices. It includes a list of all the appendices used in the study.

19. The nineteenth part of the report is a list of references. It includes a list of all the sources used in the study.

20. The twentieth part of the report is a list of tables. It includes a list of all the tables used in the study.

21. The twenty-first part of the report is a list of figures. It includes a list of all the figures used in the study.

22. The twenty-second part of the report is a list of appendices. It includes a list of all the appendices used in the study.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R. L. Westemeier

One approach to evaluating the responses of prairie chickens to habitat manipulation is to consider the number of cocks present on or within 0.8 km (0.5 mile) of managed habitat. Although land acquisition for sanctuaries began in 1962 and 1967 in Jasper and Marion counties, respectively, amounts of nest cover were not substantial until 1967 in Jasper County and 1971 in Marion County.

The density of cocks on or near the Jasper County sanctuaries averaged 105.6 per 1.6 km² (1 mi²) of nest cover over the 14-year period of 1967 to 1980. Population density reached the phenomenal level of 136 cocks on the largest tract of 94 ha (232 acres, Yeatter-Field-McGraw unit) in the spring of 1972, or a density of 375 cocks per 1.6 km². In Marion County, densities have averaged 66.6 cocks per 1.6 km² of nest cover on sanctuaries since 1971 (10 years). Because there is little nest cover for chickens on nearby private farmland, these data largely reflect the productivity of the nest habitat on the sanctuaries.

Kirsch (1974)* suggested a goal of 100 cocks per 1.6 km² of managed habitat that was based largely on responses by prairie chickens in Illinois. This goal still appears realistic; densities for 14 years in Jasper County and 10 years in Marion County, by 1980, averaged 93.5 cocks per 1.6 km² of nest cover on sanctuaries in Illinois. Although the Illinois data include 2 years of "abnormal" population highs, they also include 2 years of low density. Also, several sanctuaries are little used by chickens (MWRL 23(6):2-3).

The estimated 334 prairie chickens in Illinois in the spring of 1980 (MWRL 23(4):2-3) are few compared with the national population of some 500,000 greater prairie chickens. However, from the standpoint of density, Illinois' remnant prairie chickens are doing quite well.

Effective 16 July 1980 the Project Leader was employed by the Illinois Natural History Survey on funds appropriated to that agency for prairie chicken research. The P-R prairie chicken research project will continue, at least through FY 81, but will be amended to reflect the reduced budget. Effective 1 September 1980, Mr. John E. Buhnerkempe will join this project as Assistant Supportive Scientist on Natural History Survey funds. Mr. Buhnerkempe received his M.S. degree from Eastern Illinois University in 1979. He worked on this project during the summers of 1975-79 and again for about 6 weeks in the summer of 1980. He also conducted his thesis research on the prairie chicken sanctuaries.

Ecology and Management of White-tailed Deer - W-87-R

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

The winter and spring ranges of a yearling, female, white-tailed deer were determined by radiotelemetry. The winter range, described last month (MWRL 23(6):3), was on private land east of, and adjacent to, Allerton Park, Piatt County, Illinois. The spring range was a much smaller area within the Park and coincided with part

*Kirsch, L. M. 1974. Habitat management considerations for prairie chickens. Wildl. Soc. Bull. 2:124-129.

1. Introduction

The purpose of this study is to investigate the effects of the proposed changes on the system. The study is divided into two main parts: a theoretical analysis and an empirical study. The theoretical analysis will focus on the conceptual framework and the empirical study will focus on the data collection and analysis.

The study is organized as follows. Chapter 2 presents the background and the motivation for the study. Chapter 3 describes the research methodology. Chapter 4 presents the results of the theoretical analysis. Chapter 5 presents the results of the empirical study. Chapter 6 discusses the implications of the findings. Chapter 7 concludes the study and provides recommendations for future research.

The study is based on a combination of qualitative and quantitative methods. The qualitative methods include interviews, focus groups, and document analysis. The quantitative methods include surveys, experiments, and statistical analysis. The study is designed to be both exploratory and confirmatory.

The study is limited by several factors. First, the sample size is relatively small. Second, the study is based on self-reported data. Third, the study is limited to the specific context of the study.

The study is expected to contribute to the understanding of the effects of the proposed changes on the system. The findings will be used to inform the design and implementation of the system. The study will also provide a basis for future research on the effects of the proposed changes on the system.

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J. P. Hester
J. E. Hester

The study is expected to contribute to the understanding of the effects of the proposed changes on the system. The findings will be used to inform the design and implementation of the system. The study will also provide a basis for future research on the effects of the proposed changes on the system.

of the winter range of a radio-monitored, adult female that was described in the May newsletter (MWRL 23(5):4). The yearling was first seen on her spring range after 25 April, which was the last date that the adult female was on her winter range.

The spring range of the yearling was 29.4 hectares (72.7 acres) with a major axis of 1,079 m (0.67 mile) oriented in a north-south direction and a minor axis of 325 m (0.2 mile). Habitat types found within this range are described in Table 3. The deer was usually found, night and day, in successional black locust areas and was occasionally seen around dusk in a grassy area where we have put block salt.

The yearling remained on the spring range until 9 June, after which time she was located as follows: 11 June, 2,900 m (1.8 miles) east of the spring range (1,218 m or 0.76 mile east of the winter range); 13 through 16 June, 1.5 miles southeast of Bondville, Champaign County, Illinois, 2,718 km (17.25 miles) east of the capture point, which is within the winter range; and 17 June, along the Salt Fork of the Vermilion River 1.5 miles north of Homer, Champaign County, Illinois, 56.4 km (35 miles) east of the capture point. Throughout this movement the yearling has been accompanied by an unmarked deer of the same size, believed to be her sibling. We have no explanation at this time as to why she moved this great distance or chose this direction.

Table 3. Types of habitats found in summer range of yearling, female, white-tailed deer and the proportions in which they occur.

Habitat Type	Area		Percent of Total Range
	Hectares	Acres	
Successional hardwoods (mixed), pole-sawlog size; seedlings-sapling size upland hardwoods, rose, raspberry, gooseberry understory.	2.5	6.2	8.5
Successional hardwoods (black locust), pole-sawlog size; raspberry, rose, gooseberry, hawthorn, wild crab understory.	3.3	8.2	11.2
Successional hardwoods (black locust), pole-sawlog size; seedling-sapling size successional and upland hardwoods understory.	3.0	7.4	10.2
Successional hardwoods (mixed), seedling-sapling size; raspberry, rose, gooseberry, hawthorn, wild crab understory.	6.4	15.8	21.8
Successional hardwoods (mixed), seedling-sapling size; seedling-sapling size mixed upland hardwoods understory.	0.9	2.2	3.1
Upland hardwoods (oak-hickory), pole-sawlog size; raspberry, rose, gooseberry, hawthorn, wild crab understory.	5.4	13.3	18.4

Upland hardwoods (oak-hickory), pole-sawlog size; seedling-sapling size upland hardwoods understory.	3.2	7.8	10.7
Upland hardwoods (mixed mesophytic), pole-sawlog size; seedling-sapling upland hardwoods understory.	2.2	5.6	7.6
Bottomland hardwoods (mixed), pole-sawlog size; seedling-sapling size bottomland hardwoods, grass, forbs understory.	1.0	2.5	3.4
Conifers (Norway Spruce), pole-sawlog size; grass, forbs understory (roadside).	1.0	2.5	3.4
Grass, forbs	0.5	1.2	1.7

Cooperative Waterfowl Research - W-88-R

F. C. Bellrose,
S. P. Havera

This new project was approved effective 19 May 1980; however, by 31 July 1980 the necessary paperwork had not been completed. Thus, the project will not begin until sometime in August 1980.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

August, 1980

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Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

The success of the Department of Conservation's (DOC) seeded roadside program depends in part on maximizing long-term cooperation (delayed mowing) by participating farmers. Therefore it is important to determine whether farm operators who voluntarily participate in the Roadsides for Wildlife program are more likely to adhere to the 1 August delayed mowing schedule than individuals whose participation has been solicited by the DOC. Solicited cooperators generally controlled roadsides that were graded for roadbed and drainage improvements prior to contacts by the DOC (MWRL 22(8):1).

Delayed mowing on selected seeded roadsides was monitored for the second year in 1980, and mowing by volunteer and solicited participants was compared. Table 1 depicts the extent of delayed mowing to 15 and 31 July 1979 and 1980 on monitored seeded roadsides.

These data--although insufficient for definitive conclusions--suggest that cooperation in delayed mowing over a period of years may not be different among solicited and volunteer participants (Table 1).

Table 1. Percentage of seeded roadsides controlled by volunteer and solicited participants unmowed through 15 and 31 July 1979 and 1980.

Type Cooperator	Location of Seedings	Miles	Percent Unmowed			
			1979		1980	
			7-15	7-31	7-15	7-31
Volunteer	Scattered ^a	146.0	76	68	81	61
Solicited	Scattered ^b	82.7	79	68	79	61
Solicited	Block ^c	72.5	76	61	79	56

^aLocated in 21 townships in Ford and Champaign counties.

^bLocated in 12 townships in Ford County.

^cThe 20-square-mile Ford County Management Unit.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

Theoretically, fox squirrels with heavy body weight should be better able to withstand an unfavorable environment, such as winter weather or food shortages, than lighter squirrels. More body weight usually means more body fat with which to maintain a positive energy balance when faced with low food stocks or the inability to obtain food in adverse weather.

To test this assumption, we compared the body weights at initial capture for adult (1.5+ years) male and female fox squirrels that survived from fall-to-spring and from spring-to-fall with those that did not survive. We found no significant difference ($P > 0.05$) in initial body weight for survivors and nonsurvivors of both sexes for either period. For both sexes, body weights were heavier for survivors (males mean = 825.2 g, females mean = 809.3 g) than for nonsurvivors (males mean = 806.4 g, females mean = 780.0 g) for the fall-to-spring period, but the reverse was true for the spring-to-fall period.

For the years tested, tree-seed crops were good-to-excellent, so it is unlikely that squirrels were stressed by poor nutrition. Squirrels probably had a sufficient amount of body fat to survive normal weather conditions.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R. L. Westemeier

Maintenance of attractive nest cover for prairie chickens and associated grassland wildlife on sanctuaries continues to be a major burden of management. Some meadows become invaded with multiflora rose or weedy forbs in as little as 3 or 4 years, whereas others may last for up to 12 years before plowing becomes necessary. The average life of a mixed stand of redtop and timothy is about 8 or 9 years. By then meadows are little used by nesting prairie chickens and management by grass-seed harvesting is no longer feasible. Baling and removal of the excess grass residue from combining is vital to the longevity of a grass-seed meadow.

The primary approach to controlling succession and reseeding nest cover has been to follow a rotation of (1) fall plowing of old sods, (2) soybeans for 1 or 2 years including the use of herbicides, (3) wheat or oats, (4) red clover, and (5) reseeding to a redtop-timothy mixture (MWRL 23(1):2-3). Although this rotation provides for booming grounds, feeding (waste grain, greens, and insects), dusting, roosting, and brooding for prairie chickens, it limits the annual average amount of nest cover that a sanctuary can provide to about 65% of the acreage. Four or 5 years are required from plowing to reseeding before a given field is again providing quality nest cover. Safe, attractive nest cover is the critical missing component of prairie chicken habitat on Illinois farmland. Cover types for the other vital activities in the life history of prairie chickens are generally provided on private land adjacent to sanctuaries.

The current high market price of redtop and timothy seed may help shorten the time required for renovating old meadows. In 1979 and 1980 the base price paid to farmers for redtop has ranged from \$1.00 to \$2.00 per lb. Timothy prices are now \$0.35 to \$0.40 per lb. At these prices, income may reach \$400 per acre (although average per-acre income is substantially lower), to be shared with tenants and The Nature Conservancy or the Department of Conservation. There is little production cost to this grass-seed farming compared with soybean or corn farming.

Several lessees are currently willing to plow old meadows in August and reseed them directly to redtop-timothy the same month. Plowed fields are fertilized (typically with 100 lb per acre of 18-46-0 and 100 lb per acre of 0-0-60), disked, seeded with 4 lb per acre of redtop and 2 lb per acre of timothy, and then rolled. Spraying with 2, 4-D appears to be essential the following spring because control of Solidago spp. and other perennial forbs and woody sprouts is not as good as with the longer rotation. This approach is being tried on several sanctuaries, and if moderately successful, the percentage of nest cover available on each sanctuary unit may be increased from about 65% to perhaps 90% annually.

Ecology and Management of White-tailed Deer - W-87-R

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

From mid-February through June 1980, all observations of deer were recorded by date, time, location, and general weather conditions. These records began after several deer had been captured and marked in Allerton Park. Observations were made during spotlighting sessions at night and during the day while working in the park. Table 2 summarizes observations of marked and unmarked deer for 2-week periods in 1980.

The number of deer seen peaked during the first half of April but decreased sharply in late April and early May. This decrease coincided with the blossoming of vegetation in the woods. As deer made increased use of the woods, they were less likely to be observed from the road.

Forbs and grasses began to green-up during the last week of March. Buds on understory shrubs broke during the second week of April. Understory trees began to leaf-out 18-22 April. By the week of 27 April, understory grasses and forbs were 6-8 inches tall and leaves were sprouting on the canopy trees.

The mean number of deer per group shows 2 substantial decreases that coincide with other observations. The first decrease (from the first half of April through the first half of May) was evidently the principal break-up of the winter herds into smaller groups--probably into complete or partial family groups. At this time, some of the marked deer dispersed from the park.

The second decrease occurred from the end of May to the first part of June. This is the pre-fawning and fawning period in central Illinois, and the decrease in the number of deer per group reflected the isolation of adult females in preparation for fawning.

Table 2. Observations of marked and unmarked white-tailed deer by age and sex for 2-week periods 15 February through 30 June 1980.

Period	Groups of deer seen	Adults ^a			Fawns ^b	Unk.	Total	Mean number deer/group
		Male	Female	Unk.				
15-28 Feb.	8		7		3	16	26	3.25
1-15 Mar.	15		9	3	22	63	97	6.47
16-31 Mar.	27		18		28	65	111	4.11
1-15 Apr.	64	2	22	1	44	226	295	4.61
16-30 Apr.	33	3	15		35	71	124	3.76
1-15 May	32		11		23	36	70	2.19
16-31 May	11	1	5		15	10	31	2.82
1-15 June	8		8 ^c		2		10	1.25
16-30 June	6	2	2		5	2	11	1.83

^aAdult - >1 year.

^bFawns - <1 year.

^cDeer born in 1979 considered to be adults after 1 June 1980.

Cooperative Waterfowl Research - W-88-RF. C. Bellrose,
S. P. Havera

The Cooperative Waterfowl Research Project will collate and analyze existing data on Illinois waterfowl and their ecology and present this material as a book entitled, "The Waterfowl of Illinois: Their Status and Management." This endeavor will be a major contribution to waterfowl research and management.

This project embraces analyses of waterfowl population censuses (1) in the Illinois River valley for over 40 years, (2) in the Mississippi River valley for 35 years, and (3) in other regions of Illinois for periods of 5-10 years. The status of waterfowl populations in Illinois during these time spans can be compared with that in the Mississippi Flyway and the nation.

Past records of the waterfowl harvest in Illinois obtained from public shooting grounds and over 300 private clubs permit investigation of the regional importance of the waterfowl harvest in Illinois and evaluation of the effect of weather, population levels, and hunting regulations on bag limits.

The Illinois Department of Conservation and the Illinois Natural History Survey have banded over 100,000 waterfowl. Analyses of the recoveries from these bandings would further delineate migration patterns and population survival.

Data on the acreages and quality of wetlands in Illinois--their degradation and their enhancement--invite evaluation. Current important waterfowl food resources need to be identified along with factors that regulate their availability.

A determined effort will be made to establish guidelines and priorities for future management of waterfowl habitat and populations in Illinois.

Illinois is unique in having censused waterfowl populations longer than any other state and in requiring private clubs to keep records of their daily kill. Few states have banded as many waterfowl as Illinois or have as thoroughly documented the ecology of their wetlands. This material should be assembled in a compendium of facts relating to waterfowl management and research. Such a book would benefit waterfowl managers, researchers, naturalists, teachers, hunters, and bird watchers not only in Illinois but far outside its borders. It would provide information vital to flyway and national management of waterfowl and would provide a firm foundation for future management and research in Illinois and the Midwest.

Because of the wealth of material available, approximately 5 years will be needed to compile, interpret, and publish the information.

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Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Land use on the Sibley Study Area (SSA) was monitored in 1980, as in previous years, by mapping the crops and field boundaries on aerial photographs. Acreages of tame hay were at a record low of 0.8% of the land area (139 acres), compared with 1.2% in 1979, 1.6% in 1978, 1.2% in 1977, and with an average of 7.0% per year during 1962-69. Small grains were planted on 1.3% of the SSA (303 acres), compared with 0.9% in 1979 and 1978, 1.4% in 1977, and with a yearly average of 8.3% during 1962-69. Row crops were planted on 90.8% of the SSA in 1980, similar to corn and soybean acreages planted from 1977 to 1979.

This year, for the 8th consecutive summer, pheasant nest studies were conducted on the Ford County Management Unit (FCMU). Densities of hatched nests averaged 0.7 per acre on seeded roadsides in 1980, compared with 1.30, 1.23, 0.27, 0.48, 0.12, 0.09, and 0.07 per acre in 1973-79, respectively.

The estimated total of nests hatched in all nonrow-crop cover types on the FCMU is noted for 1976-80 in Table 1. In the June Research Letter (MWRL 23(6):1) it was suggested that pheasant populations on the study areas had recovered from winter storm-related mortality to the approximate level of abundance noted in the spring of 1977. The number of nests hatched per section in 1980 tend to confirm that observation (Table 1). In fact, cock calls (May) on the FCMU for the past 5 years have provided an accurate prediction of the estimated number of hatched nests on the area the subsequent summer ($r^2 = .96$).

Table 1. Cock calls per 2-minute stop (May) and estimated numbers of nests hatched per section on the 20-square-mile FCMU, 1976-80.

	Year				
	1976	1977	1978	1979	1980
Cock calls	22.9	7.8	6.4	6.1	11.4
Nests per section	8.0	2.2	1.3	1.1	2.2

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

Subadult fox squirrels frequently disperse from the area where they were born, due either to an innate (genetic) dispersal tendency or to harassment by older squirrels (social stress). Which of these 2 influences is a greater cause of fox squirrel dispersal is not known. We do know that some subadults remain close to their birth area, which suggests that an innate dispersal tendency, although perhaps present in all subadult fox squirrels, is associated with a variable response to agonistic adult behavior. Murray (1967. Ecol. 48:975-978) felt that the only difference between possible dispersing animals in distance moved lies in their ability to procure a breeding site; e.g., how effectively they resist adult harassment.

On our 112-acre study area near Danville, Illinois, we compared the number of male and female subadults captured within the home range of an adult male or female during spring (breeding period) and fall (postbreeding) livetrapping. We used trap captures of subadults captured in the same live traps as an adult during the same trapping period to indicate home range overlap.

In the spring there was no difference in the abundance of subadult males and females in the home ranges of adult males (98 male:97 female subadults) or in home ranges of adult females (81 male:80 female subadults). During fall livetrapping, we found a nearly significant difference ($0.10 > P > 0.05$) between the abundance of subadult males ($N = 65$) and subadult females ($N = 91$) in the home ranges of adult males but not in the ranges of adult females.

Adult males may be less tolerant of subadult males than of subadult females during the fall, but it is also possible that subadult females are easier to livetrapped during the fall. We assume that the sex ratio at birth is 50:50 and that mortality rates are similar for both sexes. We have no evidence that these assumptions are false, although most published reports show increased numbers of males shot or trapped during the fall. However, the increased number of subadult males shot compared with subadult females may be the result of hostile adult males forcing these subadult males to disperse. Dispersing animals are considered to be more prone to accidents and predation than residents, although there is little hard evidence to show that they are. Studies in Michigan have demonstrated that the age class most vulnerable to shooting is subadult males and that adult males are the least vulnerable. Most exploited (hunted) populations seem to contain an excess of males during the fall. Such exploited populations may function as "dispersal sinks" where, in the absence of adults shot by hunters, dispersing subadults settle, many of them destined to be shot in turn. If most of these dispersing subadults are males driven out by adult males, we would expect fall-shot samples to contain more males than females. During an earlier study we found that hunter-shot samples of subadult fox squirrels in Illinois averaged 59% males ($N = 2,481$) in the south zone and 52% males ($N = 1,366$) in the north zone.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R.L. Westemeier,
J.E. Buhnerkempe

Analysis of annual population fluctuations with nesting success for the greater prairie chicken has shown that approximately a 50% nest-success rate is needed to maintain a stable population on the sanctuaries in Jasper County (MWRL 22(9):3). Nest-success rates were below 50% in 6 of the past 7 years at Bogota; thus it was decided that some predator control measure would be desirable.

In recent studies dealing with predator control, lithium chloride (LiCl) was found to be a safe, nonlethal, potential control agent. Predators consuming LiCl-treated bait become nauseous and thus are aversely conditioned to that particular bait. Unfortunately, LiCl is still relatively untested as a possible agent for reducing egg predation.

This spring on 18 March, 24 dummy nests, each containing 2 domestic chicken eggs, were distributed on the Yeatter-Field-McGraw sanctuary unit. The eggs were injected with 1.5 cc of LiCl solution (1 g LiCl to 2 cc H₂O). These dummy nests were checked weekly from 24 March to 24 June. A fresh injected egg was added to each nest each week until a clutch of 7 treated eggs was reached. If a nest was destroyed, it was recorded and a new dummy nest was initiated 5 yards away.

Over the 14-week test period, there were 70 instances of predation on the 24 dummy nests with a total of 150 to 326 eggs (46%) eaten by predators. Predation on the dummy clutches was variable among weeks, but a gradual decline was evident over the test period. We cannot say if the decline in predation represented control or was due to factors such as increased cover density or availability of alternate foods. However, we doubt that the LiCl-treated eggs significantly reduced nest predation. The availability of dummy clutches may have increased predation. Of the 17 prairie chicken nests of known fate found on the Yeatter-Field-McGraw sanctuary unit, only 7 were hatches. This 41% nest-success rate was the 5th lowest success rate in 18 years on this unit. Also, all of the 4 ring-necked pheasant nests found on the unit were destroyed. However, on the Donnelley Sanctuary (no injected eggs), 5 of the 7 prairie chicken nests hatched (71%) and 1 of the 2 pheasant nests hatched.

Ecology and Management of White-tailed Deer - W-87-R

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

During late winter 1980, 21 deer were captured and marked in and around Allerton Park, 4 miles southwest of Monticello, Piatt County, Illinois. Four of these deer, 3 adult females and 1 fawn female, were fitted with radio-transmitter collars. Each radio-monitored deer moved a relatively long distance away from the park. In some cases, the exact date of movement is known and in others there are a number of possible dates.

An attempt was made to relate some weather conditions to the time and direction of travel for each monitored deer. Table 2 lists distance, direction, and dates of movement for each deer, and weather conditions.

Table 2. Temperature, wind speed and cloud cover on probable dates of dispersal by radio-monitored, white-tailed deer. Weather data were taken from monthly summaries of local climatological data obtained from the Urbana station.

Tag No.	Possible Date	Distance Moved		Direction Moved	Wind ^a		Temperature (°F)			Sky ^b
		Miles	Kilometers		Direction	Speed (mph)	High	Low	Mean	
286	3/8	3.2	5.1	NE	NW	6.4	36	30	33	Cld
286	3/22	6.0	9.7	NE	SE	3.4	49	29	39	Clr
286	3/23	6.0	9.7	NE	SE	6.0	54	35	45	Cld
266	4/22	4.6	7.3	NE	SW-NW	11.2	89	54	72	Clr
266	4/23	4.6	7.3	NE	E	3.0	73	48	61	Clr
266	4/24	4.6	7.3	NE	NE-E	2.6	49	38	44	Clr
238	4/25	12.2	19.7	SE	NE	3.2	58	34	46	Clr
238	4/26	12.2	19.7	SE	N	6.8	61	37	49	Clr
276	6/9	2.2	3.5	NE	W	5.4	79	54	67	Clr
276	6/10	16.5	26.6	ENE	NE-SE	5.0	70	52	61	PC
276	6/11	16.5	26.6	ENE	SE-S	3.2	76	47	62	Clr
276	6/16	18.0	29.0	ESE	NE-SE	2.3	69	50	60	PC

^aSW-NW means that the wind was SW in the evening shifting to NW in the morning hours following passage of a cold front.

^bCld = cloudy; Clr = clear; PC = partly cloudy.

Deer 286 left the park less than 2 weeks after capture and within 2 or 3 days after we disturbed her; perhaps we influenced the time of her movement. Her course of travel seemed to follow the Sangamon River and showed no relation to wind direction.

Deer 266 also followed the Sangamon River, but she turned away from the main river and followed Camp Creek past Monticello. If she moved 24 April, it was on a cool night that followed a week of warm temperatures.

During this same cool period, deer 238 left the park. Her course of travel did not seem related to wind direction nor did it follow a river. Some ideas concerning migration or homing to a traditional fawning area have been considered but are no more than speculation at this time.

Deer 276 is the only fawn female carrying a transmitter. She left the park much later than the others--during the first week of June at the peak of fawning. Perhaps her movement on 9 June was stimulated by pre-fawning aggressive behavior by the adult female that was often seen with deer 276. This initial movement was along the Sangamon River through part of her winter range.

The remaining movements of deer 276 showed no relationship to temperature or river systems, but all of her movements, except the 1st one, were against the wind. We do not know if this phenomenon indicates an influence of the wind on the time and direction of her travel. Perhaps she was able to smell the forested areas along the Salt Fork of the Vermilion River when the wind was from the east and this scent influenced her movement. The dates she moved, with 1 exception, were the only days on which the wind was easterly.

Cooperative Waterfowl Research - W-88-R

F. C. Bellrose,
S. P. Havera

A knowledge of the preferred foods of waterfowl in various habitats is necessary for the management of waterfowl food resources. The last extensive food-habits study in Illinois was based on waterfowl gizzards collected in 1938 through 1940. Since that time, pollution and sedimentation have altered the food resources of our streams and rivers. Farming practices, such as efficient combines and fall plowing, have drastically reduced the availability of waste grain. Because the welfare of waterfowl is intrinsically tied to food supply and its quality, it is important to determine the current food habits of waterfowl in Illinois and the availability of these foods.

One objective of our waterfowl study is to examine gizzards for food items in order to compare current food habits with previous studies to evaluate diet differences resulting from habitat changes. We began collecting gizzards from a variety of waterfowl at selected areas during the fall of 1978. During the hunting season of 1979, approximately 3,400 mallard gizzards were collected in conjunction with a lead-shot-ingestion study by the Department of Conservation. The majority of these mallard gizzards were collected from the Illinois River Valley with a fair representation from the Mississippi River area as well as from lakes and reservoirs in central and southern Illinois. Additional gizzards from mallards, the principal duck harvested in Illinois, will be collected during the fall of 1980.

Knowledge of the current food items used by waterfowl and acquisition of more information on enhancing the availability of major food species should better enable us to manage waterfowl lands.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

October, 197⁸⁰~~76~~

Vol. 23, No. 10

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Last month (MWRL 23(9):1) we indicated that breeding populations of pheasants on 5 study areas in east-central Illinois had recovered from winter storm-related mortality to the approximate level of abundance noted in 1977. Numbers of hatched nests on the Ford County Management Unit (FCMU) were congruent with the noted level of recovery.

However, late summer brood censuses on the FCMU, Sibley Study Area (SSA), and Anchor, Harwood, and Prairie Green areas show no improvement over 1979 in the rate of recruitment of young into the fall population (Table 1). For all areas, an average of 4.4 broods was observed per 100 miles of driving in August 1980, indicating little increase over the 3.9 per 100 miles observed in 1979. Numbers of chicks observed per brood decreased from 5.9 in 1979 to 4.7 in 1980.

The disparity between observed broods and the greater numbers of juveniles expected from the spring population data has no obvious explanation. The 6 weeks following the mid-June peak of hatches were unusually hot and dry; this weather may have impaired the survival of young pheasant chicks. Although other studies have noted that hot, dry periods may reduce survival rates of broods, there are no empirical data that relate mortality to similar weather conditions.

Possibly our brood counts were biased by the infrequency of optimal censusing conditions: relatively cool mornings with heavy dew. However, the differences between counts taken in 1980 under relatively good and poor conditions were small.

Hunter harvest data, to be collected in November, may provide further insights into the poorer-than-expected recruitment of juveniles into the fall pheasant population on the study areas.

Table 1. August broods observed per 100 miles of driving in 5 study areas in central Illinois.

Year	SSA	FCMU	Anchor	Harwood	Prairie Green
1977	2.3	26.9	5.2	7.0	5.7
1978	1.0	0.6	2.0	4.3	2.5
1979	2.9	4.4	0.7	7.5	3.9
1980	2.3	4.4	5.7	5.0	4.6

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

Within an unexploited (unhunted) fox squirrel population that we studied near Danville, Illinois, the proportion of adult (1.5 years +) and yearling female fox squirrels breeding during the 2 main breeding seasons (spring = Jan-Mar, summer = May-July) was negatively correlated with the number of squirrels (both sexes) present during the breeding season ($r = -.522$) (MWRL 23(7):2). This correlation suggests that squirrel density is an important regulator of breeding rates and may account for the considerable difference in the number of females that breed in spring vs. those that breed in summer (Table 2).

These breeding rates are significantly lower ($P < 0.01$) in the summer for the 1.5- and 2.0-year classes. The difference in yearling breeding rates approached significance ($0.10 > P > 0.05$). Squirrel densities increase in May and June as the spring-born young are weaned and leave the natal den. This period coincides with the time the summer young of the previous year (yearlings) also disperse, creating a potential for considerable conflict between resident and immigrating squirrels. We do not know if social interaction at this time creates stress among breeders that blocks the normal estrous cycle or if agonistic behavior between potential breeders actually represents a denial of access to the food and shelter that females need to stimulate the reproductive hormones leading to estrus.

Table 2. Percentage of female fox squirrels breeding in each age class during the spring and summer breeding seasons.

Age at breeding (years)	Spring			Summer		
	Number of females	Number breeding	Percent breeding	Number of females	Number breeding	Percent breeding
.8	32	0	0	61	0	0
1.0	42	12	28.6	10	0	0
1.5	49	36	73.5	33	8	24.2
2.0+	114	87	76.3	80	35	43.7
Totals	237	135	56.9	184	43	23.4

Responses of Prairie Chickens to Habitat Manipulation-W-66-R

R.L. Westemeier,
J.E. Buhnerkempe

During late spring and summer of 1980, 464 acres of nest cover on sanctuaries were systematically searched for prairie chicken nests. Nests of other grassland birds and mammals were also recorded. In Jasper County, 27 prairie chicken nests were found in 447 acres of nest cover. Among 24 nests of known fate at Bogota, 12 were hatches. This level of 50% hatch success usually indicates a stable population between spring counts (MWRL 22(9):3). All 12 nest losses were due to predation, primarily by the striped skunk.

In Marion County, of 4 nests located, 3 hatches were found in 15 acres of red clover on the Butler Sanctuary and 1 nest on private land was abandoned, probably due to human disturbance.

The density of prairie chicken nests in 1980 dropped 25% compared with 1979 despite a population of chickens at Bogota in the spring of 1980 that was 35% higher than the previous spring (MWRL 23(4):2-3). We are unable to explain this decline. The density of chicken nests (0.6 nest/4 ha) was only 51% of the long-term mean, whereas the population level was 98% of the long-term mean.

Nest densities for 2 species, the pheasant and red-winged blackbird, were 207% and 50%, respectively, of their long-term means. However, 9 species of birds, including the bobwhite quail, mourning dove, meadowlark, upland sandpiper, grasshopper sparrow, dickcissel, field sparrow, short-billed marsh wren, and goldfinch, plus the cottontail, showed lower nest densities than the prairie chicken. The percentage of the long-term mean for nest densities of each species was lower than was the case for the prairie chicken.

Thus, the 1980 nest search did not reveal a recovery of native bird and mammal populations on the sanctuaries following the mild winter of 1979-80. The prairie chicken continues to do relatively well compared with other species that nest on the sanctuaries.

Ecology and Management of White-tailed Deer - W-87-R

C. H. Nixon,
L. P. Hansen,
J. E. Chelsvig

Spring movements of radio-monitored deer were described in the last report (MWRL 23(9):3) and some weather characteristics for the possible movement dates were examined. This report will focus on 1 deer from that same group that has made long-distance fall movements.

Deer 238, an adult female, was the first animal fitted with a radio collar during this study and has provided a large amount of data concerning movements and habitat use. This deer occupied her winter range, described last May (MWRL 23(5):4), until 25 or 26 April. She then moved to her summer range, approximately 12 miles southeast of Allerton Park, where she stayed until 27 or 28 September. On 29 September she was radio-located and observed on the southern part of her former winter range with both of her 1980 fawns. All movements and various weather factors are described in Table 3.

Deer 238's return in the fall to her winter range was expected, but the timing and navigation mechanisms are still unclear. Weather does not seem to be strongly related to the timing of this first fall movement, though both the fall and spring movements occurred on relatively clear nights near the time of full moon. Moonlight would aid navigation by landmarks, but about 75% of the crops were still in the fields blocking the deer's view of the topography. From these observations one can speculate that deer can orient to the moon to maintain direction while traveling; lunar orientation has been demonstrated in other species.

Possibly Deer 238 followed small drainage ditches that course through the area. These ditches offer little cover but would aid direction finding for at least part of the journey.

The best explanation we have for the timing of this fall movement is that it was triggered by secretions of the endocrine system, possibly gonadotrophic hormones from the pituitary gland. These hormones are produced in females in response to the shortening days and preparatory to breeding in the fall.

On 7 October, Deer 238 repeated the movement she made in the spring and returned to her summer range (Table 3). We see no ecological advantage to the deer in this movement and offer no explanation for it. Future observations may provide more insight into the controls of these movements.

Table 3. Characteristics of spring and fall movements of an adult, female white-tailed deer (Deer 238) and a description of some environmental conditions on the possible dates of movement. Weather data obtained from the Urbana station.

Date	Displacement			Temperature			Wind		Sky ^a	Lunar ^b Phase
	Mi	Km	Direc- tion	High	Low	Mean	Speed (mph)	Direc- tion		
4/25	12.2	19.7	SE	58	34	46	3.2	NE	Clr	Full-5
4/26	12.2	19.7	SE	61	37	49	6.8	N	Clr	Full-4
9/27	12.2	19.7	NW	70	40	55	4.0	SW	PC	Full+3
9/28	12.2	19.7	NW	78	45	62	2.0	SE	Clr	Full+4
10/7	12.2	19.7	SE	75	46	61	4.5	SW	Clr	New-1

^aClr = clear, PC = partly cloudy

^bLunar phase given as the number of days before (-) or after (+) full or new moon.

Cooperative Waterfowl Research - W-88-R

F. C. Bellrose,
S. P. Havera,
G. A. Perkins,
H. K. Archer

Illinois is 380 miles long and has such diversified habitat as tamarack bogs in the north and cypress swamps in the south. Because it extends over such a range of latitude, different regions of the state are subject to a diverse chronology in the arrival and departure of waterfowl. A variety of wetlands also influences the distribution of waterfowl within Illinois.

Illinois is subject to dramatic climatic and weather changes between seasons and years not only in temperature, but also in precipitation, snowfall, and

floods. Numerous waterfowl refuges have been established in Illinois. The recent creation of power plant cooling lakes and flood control-recreation lakes has provided waterfowl with new habitat. The effects of climate, weather, refuges, and cooling lakes on waterfowl distribution, abundance, and chronology of migration needs clarification.

To answer such questions, we will analyze census data that have been collected by the Natural History Survey. Fall waterfowl have been censused in the Illinois River valley for 41 years, in the Mississippi River valley for 34 years, in southern and south-central Illinois for 8 years, and in northeastern Illinois for 4 years. Winter waterfowl censusing began in 1949. Spring waterfowl censuses have been collected in the Illinois and Mississippi valleys for 17 years. These data will be placed on computer tapes and interpreted.

Examination of this wealth of census data should contribute to future management strategies by helping us evaluate Illinois' role in the waterfowl resource each season, select the wisest time for the waterfowl hunting season, and establish or enhance waterfowl refuges in critical areas.

Incat.

MONTHLY WILDLIFE RESEARCH LETTER

ILLINOIS NATURE SURVEY

1980

Illinois Federal Aid Projects W-66-R, W-87-R, and W-68-R

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Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

The success of pheasant hunters was monitored on study areas in east-central Illinois during opening weekend of the upland game season this year (8-9 November 1980), as has been the tradition for 2 decades. The numbers of hunters on the Sibley Study Area (SSA) and Ford County Management Unit (FCMU) were similar to numbers noted in 1978 and 1979, with perhaps a slight decline in hunters on the FCMU.

Hunter success improved markedly in 1980 over 1979 (Table 1). Time expended per cock harvested averaged 9.9 hours on the SSA in 1980, compared with 71.0 hours in 1979, and 5.3 hours on the FCMU in 1980, compared with 11.1 hours in 1979. Hunter success (time per bird) in 1980 was similar to that in 1976 (Table 1).

The improved hunter success this fall, compared with 1979, probably reflects both a slight-to-moderate increase in numbers of pheasants and the concentration of pheasants in the residual cover by the unusually early completion of fall plowing.

Table 1. Pheasant hunting statistics on the Sibley Study Area (SSA) and Ford County Management Unit (FCMU) during the opening weekend of the upland game season, 1973-80.

	1973	1974	1975	1976	1977	1978	1979	1980
Parties interviewed ^a	28	36	28	27	18	30	26	21
Parties sighting cock pheasants ^a	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	22	20
Cock pheasants bagged ^a	91	73	78	80	27	56	26	48
Percentage of birds juvenile ^a	85	71	62	74	75	84	81	76
Man-hours expended per cock bagged								
SSA	7.4	3.3	16.5	9.7	35.0	18.4	71.0	9.9
FCMU	7.4	3.1	4.7	6.2	11.6	7.9	11.1	5.3

Mathematics

Chapter 1: Introduction to Mathematics

1.1 The Language of Mathematics

1.2 The History of Mathematics

1.3 The Role of Mathematics in Science and Engineering

1.4 The Importance of Mathematical Thinking

1.5 The Foundations of Mathematics

1.6 The Language of Sets

1.7 The Language of Numbers

1.8 The Language of Algebra

1.9 The Language of Geometry

1.10 The Language of Calculus

1.11 The Language of Probability and Statistics

Man-hours expended
per cock observed

SSA	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	6.5	2.0
FCMU	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	4.2	1.6

^a Statistics for both study areas combined.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

Virtually all of Illinois' forests have been disturbed, often many times. Indiscriminate timber cutting, fires, and grazing have created a mosaic of stands, usually less than 60 years old, with varying capacities to support huntable populations of squirrels. With disturbance as the normal condition in Illinois' forests, we must seek methods to mitigate such injurious effects as reduction in food production, and to promote those effects of disturbance that should benefit squirrels, such as diversity of tree species and age classes.

Presently, no forests in Illinois, or indeed in the Midwest, are being managed for squirrels. Optimum habitat for squirrels occurs near the climax of a successional sere. Thus, production of squirrel habitat requires either time for natural succession to produce the necessary life supporting elements (usually 30 years for succession to produce a cavity- and seed-producing stand in the Midwest) or money to provide artificial shelter or supplemental foods in a young forest.

Most techniques recommended for managing forest habitats for squirrels are too general to be of much value in managing the typical Illinois timber stand. Such cliches as "good timber management is good wildlife management" will no longer suffice. Wildlife ecologists must develop models to predict consequences, good or bad, of timber management and other land uses on wildlife. Sufficient information is now available to begin this process for gray and fox squirrels.

In the coming months we will discuss various aspects of forest management to benefit squirrels in Illinois. Topics to be discussed include the following:

1. Squirrel habitat preferences in Illinois.
2. Squirrel densities and harvest by hunters.
3. Fall sex and age ratios and what they mean to the squirrel hunter.
4. Effects of clearcutting and selection logging on squirrels.
5. Managing the forest to increase oaks and hickories.
6. Methods for increasing tree seed crops.
7. Effects of nest boxes on gray and fox squirrels.
8. Methods of increasing natural shelter for squirrels, including tree cavities and the climbing vines used to anchor leaf nests.

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Responses of Prairie Chickens to Habitat Manipulation-W-66-R

R.L. Westemeier,
J.E. Buhnerkempe

Since 1963, the spring counts of prairie chickens at Bogota have fluctuated from 40 to 206 cocks, with an 13-year mean of 94. In the late 1960's, a large increase in sanctuary acreage resulted in dramatic increases in the cock population from 1969 through 1972 (Fig. 1). These increases were logistic and typical of responses by populations to substantial increases in habitat. During 1974 through 1976, however, the numbers of cocks dropped alarmingly. Reproductive performance and nest success of chickens declined during this period while, conversely, the pheasant population at Bogota was increasing. Since 1976 the population level of chickens has stabilized somewhat; a moderate increase was evident the spring of 1980.

Nest success, pheasant interaction, and weather (MWRL 22(9):3, 19(8):4, and 14(7):3) were among factors listed as affecting the population level. This report is the first of a series updating previous findings and analyzing the dynamic parameters for the population of prairie chickens in Jasper County.

Hen numbers are recorded whenever possible along with the count of prairie chicken cocks on booming grounds. Although hens frequent booming grounds much less regularly and predictably than cocks, hen counts may provide an index to population change some years. Significant correlations could not be found between hen numbers and population change, but several observations should be noted.

First, during 3 of the 4 years of population increase since 1963, the ratio between cock and hen counts approached 1:1, respectively. However, the ratio increased to 2:1 or greater when the cock population was at peak levels (1971-74).

Secondly, a highly significant correlation ($r = 0.907$, $P < 0.01$) was found between the spring count of hens and the number of nests located the following summer. In 1977 and 1980, however, large drops in the number of nests located cannot be explained by decreases in the hen counts. Such possibilities as (1) duplication of hen counts (same individuals counted on several booming grounds, (2) nesting on areas not searched, (3) hens not nesting, or (4) missed nests during annual search, may account for the variation noted in such years as 1977 and 1980.

The next report in this series will analyze and discuss egg hatchability and clutch size in relation to other prairie chicken population parameters.

Ecology and Management of White-tailed Deer - W-37-R

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

Perhaps the tremendous change in the Illinois landscape following corn and soybean harvests is a factor in the timing of deer movement from summer to winter range. This would be particularly true for deer native to the "Grand Prairie" of Illinois, where row crops occupy >90% of the land.

As previously reported, our radio-marked females used crop fields extensively between June and the completion of crop harvests in mid-October. In each case ($N = 4$), these deer had immediate access to forests or brushy areas, so their obvious preference for row crops was not due to a lack of permanent cover.

Our deer did not desert their summer range as crops were harvested, except to retreat to permanent cover. As this is written (November 14), none of the 4 deer have returned to their winter range (Allerton Park); with breeding activities in full swing, they obviously will breed on their summer range. We assume, perhaps erroneously, that adult breeders do return to the same area each winter. Deer may, however, winter in whatever "suitable" cover is available, familiar, and contains other deer.

We now wait to see if the hunting season and the onset of cold weather trigger movements toward a winter range.

Cooperative Waterfowl Research - W-83-R

F. C. Bellrose,
S. P. Havera,
G. A. Perkins,
H. K. Archer

Illinois has nearly 80,000 waterfowl hunters each year. The average waterfowl hunter harvests about 7 ducks per hunting season. Thus, we estimate that approximately a half million ducks are harvested each fall in Illinois.

Various records of the taking of waterfowl in Illinois are available for analyses. Private duck clubs have been required by the state to maintain a daily register of each hunter and the number of each waterfowl species shot since about 1930. Of the 270 private duck clubs in the Illinois River valley, some of the more successful ones report an annual harvest near 2,000 ducks. State public shooting areas in Illinois also register the waterfowl harvest. In addition, the U.S. Fish and Wildlife Service estimates the waterfowl kill in each county of the nation.

These sources of data, over time, can provide valuable insight into the harvest of waterfowl by species, geographic area, kill per unit area, and seasonal chronology. State and federal harvest data can be compared for similarity. We hope to evaluate the relationship between the proportion of Mississippi Flyway population harvested in Illinois and that harvested in other states of the flyway. The seasonal distribution of the harvest can be compared with the seasonal population abundance as determined by aerial censuses. An index to the relative vulnerability to hunters of the various waterfowl species in the state can be generated from the population and harvest data.

A major interest in our study will be to evaluate the effect on the harvest of yearly changes in waterfowl regulations: length of season, bag limits, specific opening dates, point system, and species closure on the kill. The establishment of regulations to permit a fair and equitable harvest of waterfowl among the states in the Mississippi Flyway is a prime goal in flyway management. As data are acquired on this problem, regulations can be established on a more meaningful, scientific basis.

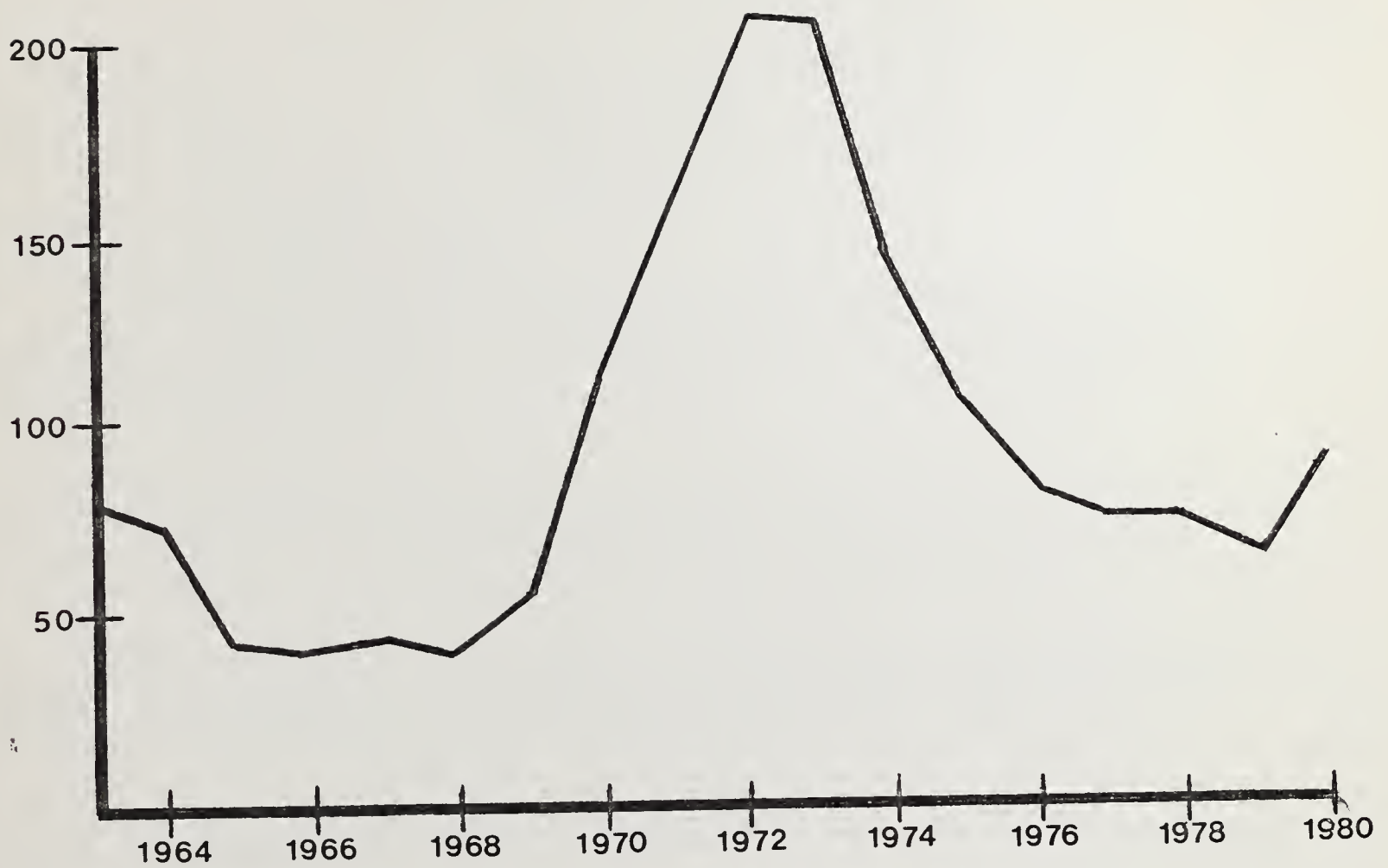


Fig. 1. The number of prairie chicken cocks censused each spring 1963-80 on the Bogota Study Area.

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

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Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

December, 1980

Vol. 23, No. 12

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

In 1973 the Department of Transportation seeded approximately 1 mile of brome-alfalfa and 1.2 miles of fescue mix along the newly constructed FAI-55 near Odell, Livingston County. The purpose of this effort was to provide for a controlled comparison of nesting by pheasants and ground nesting songbirds on the 2 types of seedings.

A total of 10 plots (6 fescue mix and 4 brome-alfalfa) totaling 6 acres have been searched twice per summer since 1977. Details of the study were noted in MWRL 21(12):1. As a result of winter storm-related mortality, too few pheasant nests have been found on the Odell plots to afford tenable conclusions.

Forty-eight songbird nests, however, have been found since 1977; 38 of the 48 nests were located in brome-alfalfa vegetation. Thus, to date, songbirds--primarily red-winged blackbirds--have nested significantly less frequently ($p < .001$) in fescue-mix plots than in brome-alfalfa.

Ecology and Management of Squirrels - W-66-RC. M. Nixon,
L. P. Hansen

Both fox and gray squirrels are best adapted to old-growth hardwood forests with a high percentage of oaks and hickories. Gray squirrels, and to some extent fox squirrels, fluctuate in density in response to the amount of storable (nuts and seeds that will keep fresh when buried or cached by squirrels) tree seed produced each fall. The virgin hardwoods that formerly covered 40% of Illinois produced at least 10 times more seed per unit of area than the typical hardwood stand today. Virgin upland mixed-hardwoods produced an estimated 38,000 to 148,000 bushels of storable tree seed (hickories, walnuts, and acorns) per square mile in contrast to an average estimated yield per square mile of 1,700 bushels from a second-growth mixed upland forest.

Squirrel response to this abundance of food was reflected in the published accounts of squirrel numbers and crop depredations. Early naturalists estimated there were at least 1 billion gray squirrels east of the Mississippi in 1800.

1. The first part of the document is a letter from the President of the United States to the Congress, dated January 1, 1861.

2. The second part is a report from the Secretary of the Treasury, dated January 1, 1861.

3. The third part is a report from the Secretary of the Interior, dated January 1, 1861.

4. The fourth part is a report from the Secretary of the Navy, dated January 1, 1861.

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15. The fifteenth part is a report from the Secretary of the Public Works, dated January 1, 1861.

16. The sixteenth part is a report from the Secretary of the Public Buildings, dated January 1, 1861.

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18. The eighteenth part is a report from the Secretary of the Public Lands, dated January 1, 1861.

Obviously we are not returning to the extensive virgin forests of 1800. However, huntable squirrel densities are common in most of the second-growth forests of Illinois; where the gray squirrel has declined, often the fox squirrel has thrived. Most squirrel hunters worry little about which species is the more abundant.

Although both gray and fox squirrels eat about the same foods and utilize tree cavities and leaf nests for shelter, they prefer different habitats. Gray squirrels are abundant in Illinois only in areas at least 20% covered by forest. In central and northern Illinois, gray squirrels are found in forests with large amounts of sugar maple, white oak, elms, and black oaks.

In an unpastured mixed-hardwood forest in east-central Illinois, gray squirrels were most common in ravine forests with large amounts of beech and sugar maple. They were also found in bottomland forests containing pecan, pin oak, maples, cottonwood, ashes, and sycamore. They avoided the upland forests.

In southern Illinois, however, gray squirrels are common in both upland and bottomland forests. Apparently, a minimum amount of forest (20% of the land area) must be present to support gray squirrels. If 20% or more of an area is forested and a minimum amount of winter storable food is present, tree composition is not so important.

Two other factors influence gray squirrel abundance: understory densities and abundance of tree cavities. All forests examined in central and northern Illinois that harbored gray squirrels contained a well-developed forest understory and at least 3 tree cavities per acre.

Fox squirrels are creatures of forest edge and are most abundant in the upland forests of Illinois. They achieve high densities in pastured old-growth woodlots; they are not abundant in the extensive bottomland forests of central and southern Illinois.

With the decline in woodlot pasturing during the past 20 years (many farmers no longer keep livestock), understory densities have increased and fox squirrel densities have declined. In these unpastured woodlands, fox squirrels are most abundant in upland stands of oaks and hickories with a high density of trees and a low density of understory. They avoid the ravine forests frequented by gray squirrels. Breeding females frequently live close to the edge of a woodlot, whereas adult males are scattered throughout the uplands.

Most forests on the public lands of Illinois can be expected to increase their yields of squirrels. These forests are relatively young (70 years), are still recovering from past abuse (fire, destructive logging, and pasturing) and will produce more food and shelter for squirrels as they mature.

Although we cannot speed up succession (except for nest boxes to replace slow-to-form tree cavities), certain techniques may be used on public lands in Illinois to enhance one or the other species of squirrel, particularly if management includes commercial logging. Next month we will discuss the effects of commercial logging on both gray and fox squirrels in Illinois.

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Responses of Prairie Chickens to Habitat Manipulation-W-66-R R.L. Westemeier,
J.E. Buhnerkempe

The importance of hatch success by nesting prairie chickens has been discussed in previous reports on the basis of the percentage change in numbers of cocks on leks (booming grounds) and the percentage hatch success (MWRL 22(9):3, 23(10):2-3). Significant correlations were found with the use of these parameters; however, higher correlation coefficients were revealed by using the spring count of cocks (dependent variable) and the number of hatched nests (independent variable) found the preceding summer. Hatches from a sample of 781 nests (reported nests on private land as well as nests on sanctuaries) versus the cock count for the years 1963-80 resulted in the highest coefficient ($r = 0.945$; $P < 0.001$) among the parameters tested. Thus, the spring population at Bogota since 1963 has been closely dependent on the number of hatched nests found the preceding summer; 89% of the variation in the spring numbers of cocks on leks has been associated with the number of hatches. Lower but highly significant coefficients were also found using hatched nests actually examined (1) on sanctuaries and private land and (2) on sanctuaries exclusively. The use of total nests as the independent variable also resulted in a highly significant coefficient ($r = 0.322$, $P < 0.001$). Thus, although hatch success of about 50% may generally indicate population stability, this "rule of thumb" may predict population change less accurately than other parameters. The best reproductive parameter we have for predicting change in the prairie chicken population at Bogota appears to be the number of hatched nests. By this measure, we predict a decline from 92 cocks in the spring of 1980 to 63.4 ± 15.0 cocks in the spring of 1981.

Fall counts of prairie chicken cocks are also highly predictive of subsequent spring population levels (MWRL 23(5):3-4). A preliminary prediction based on booming ground surveys at Bogota this fall closely agrees with the prediction based on the number of hatches.

We cannot explain why relatively few prairie chicken nests were found during the search in 1980. As in the past, the nest search was concentrated on the sanctuaries supporting the highest densities of prairie chickens. Also, such factors as stability of birds on their leks, hen numbers, and number of copulations observed all appeared "normal" in 1980. Apparently a substantial number of hens on the Bogota Study Area did not nest.

Ecology and Management of White-tailed Deer

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

Personnel working deer check stations for the 1980 shotgun hunting season were provided forms and instructed to record all sightings of marked deer by hunters as well as marked deer that were killed and turned in at the check station. Of the 22 marked deer believed to be still alive, 4 were killed during the first season and 2 were killed during the second season (Table 1).

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Only 1 marked deer, No. 260, was killed in the vicinity of Allerton Park. The others were killed some distance from the Park.

Deers 276 and 286, marked with radio collars, were being monitored at the time they were shot, both on their 1980 summer ranges.

Two bucks, Nos. 273 and 284, were killed near each other in Douglas Co. Other marked deer have been reported in that same general area. Why so many marked deer have concentrated there is unknown.

Table 1. Distances and directions of kills of marked deer from capture sites.

Tag No.	Date Killed	Age (yrs)	Sex	Location where killed	Distance		Direction
					km	mi	
273	11/21	2.5	M	3/4 mi N Chesterville, Douglas Co.	39	24	SE
250	11/22	2.5	F	2 mi E Lake Decatur, Macon Co.	19	12	SW
276	11/22	1.5	F	2 mi N Homer, Champaign Co.	61	38	E
260	11/23	1.5	M	6 mi SW Monticello, Piatt Co.	3	2	SW
284	12/12	1.5	M	2 mi N Chesterville, Douglas Co.	37	23	SE
286	12/14	2.5	F	4 mi SW Mahomet, Champaign Co.	21	13	NE

Cooperative Waterfowl Research - W-88-R

F. C. Bellrose,
S. P. Havera,
G. A. Perkins,
H. K. Archer

The waterfowl resource of Illinois is dependent upon the quantity and quality of its wetlands. The waterfowl habitat in Illinois has been subject to many forces, some beneficial but most detrimental. Detrimental factors include drainage, urbanization, and sedimentation, whereas impoundments and power plant cooling lakes have added areas for waterfowl. It is desirable to evaluate the gains and losses that have occurred in the wetland habitat of Illinois since the turn of the century, when the wetlands were virtually pristine. Most of the original wetlands have been drained.

1. The first part of the report is a general introduction to the subject of the study.

2. The second part of the report is a detailed description of the methods used in the study.

3. The third part of the report is a discussion of the results of the study.

4. The fourth part of the report is a conclusion and a list of references.

5. The fifth part of the report is a list of appendices.

6. The sixth part of the report is a list of figures and tables.

7. The seventh part of the report is a list of footnotes.

8. The eighth part of the report is a list of symbols and abbreviations.

9. The ninth part of the report is a list of acknowledgments.

10. The tenth part of the report is a list of references.

11. The eleventh part of the report is a list of appendices.

12. The twelfth part of the report is a list of figures and tables.

13. The thirteenth part of the report is a list of footnotes.

14. The fourteenth part of the report is a list of symbols and abbreviations.

15. The fifteenth part of the report is a list of acknowledgments.

16. The sixteenth part of the report is a list of references.

17. The seventeenth part of the report is a list of appendices.

During this project we hope to determine the type and amount of wetland and terrestrial habitat with value to waterfowl in the various regions of Illinois and to compare the current distribution, nature, and size of wetlands in Illinois with what they were in the 1990's. A current inventory of waterfowl habitat is needed to provide management with information on the potential "carrying capacity" of the state. This inventory, in conjunction with the evaluation of the changes in the original habitat, can be used as a basis for developing future strategies of wetland acquisition and management.

The first part of the report discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the integrity of the financial system and for the ability to detect and prevent fraud. The report also highlights the need for regular audits and the importance of having a clear understanding of the organization's financial position at all times.

The second part of the report focuses on the role of the accounting department in ensuring the accuracy of the financial statements. It outlines the various steps involved in the accounting process, from the collection of data to the preparation of the final statements. The report also discusses the importance of having a strong internal control system in place to prevent errors and fraud.

The third part of the report discusses the importance of having a clear understanding of the organization's financial position at all times. It emphasizes that this is essential for making informed decisions about the organization's future. The report also discusses the importance of having a strong internal control system in place to prevent errors and fraud.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

January, 1981

Vol. 24, No. 1

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Nest studies were initiated in 1976 on 10 selected roadside plots along FAI-55 near Odell to provide insights into (1) the comparative suitability of fescue mix and brome-alfalfa as nest habitat along interstate highways, and (2) the possibility that songbirds avoid nesting on rights-of-way along heavily travelled highways. Preliminary findings reported last month (MWRL 23(12):1) indicated that songbirds nested significantly more often ($P < 0.001$) in brome-alfalfa than in fescue-mix vegetation.

Nest searches over the past 4 years indicate an average of 2 songbird nests established per acre of interstate roadside. Densities of songbird nests along interstate rights-of-way were comparable, or slightly greater, to densities along managed rural road rights-of-way during the same period. Similar to managed roadsides along secondary and county roads, approximately 95% of the songbird nests along the Odell plots were established by red winged blackbirds (RWBB).

From established nest densities, there is no evidence that RWBB's avoid nesting on unmowed roadsides adjacent to heavily travelled interstate highways. A second question is whether songbirds tend to avoid nesting in vegetation nearest interstate pavements, where passing 18-wheel vehicles make substantial noise and blow vegetation. Songbird nests found on the Odell plots since 1977 have been located as follows: 10 on foreslopes (1-9 yards from the roadway), 16 on the ditch or midslopes (10-15 yards from the roadway), and 19 on backslopes (16 or more yards from the roadway). Although the frequency of nesting on foreslopes, ditches, or backslopes has not been significantly different ($P > 0.10$), there is a trend toward greater frequency of nesting on backslopes. This trend is similar to nesting patterns of pheasants and songbirds in managed vegetation along rural secondary roads with relatively low traffic. Rather than avoidance behavior, this slight trend may reflect the attractiveness (heights and density patterns) of vegetation on backslopes for nesting. Generally, vegetation on the backslopes is better established and grows more vigorously than on the foreslopes and midslopes.

The preliminary findings of the Odell study suggest that RWBB's do not exhibit avoidance behavior in selecting nest sites along heavily travelled interstate highways. This preliminary conclusion, however, should not be extended to other species without further research.

The data collected primarily for RWBB's have implications for management. Nearly one-fourth of all songbird nests occurred on foreslopes. Thus, delayed mowing of foreslopes is an important policy for the Department of Transportation to maintain.

THE UNIVERSITY OF CHICAGO

DEPARTMENT OF THE HISTORY OF ARTS AND ARCHITECTURE

OFFICE OF THE DEAN OF THE FACULTY OF ARCHITECTURE

CHICAGO, ILLINOIS 60637

The following is a list of the members of the Faculty of Architecture, who are also members of the Department of the History of Arts and Architecture. The list is arranged alphabetically by last name.

1. ALAN COOPER, Professor of Architecture and History of Art, is a member of the Faculty of Architecture and the Department of the History of Arts and Architecture. He is also a member of the American Academy of Arts and Letters.

2. JOHN H. COOPER, Professor of Architecture and History of Art, is a member of the Faculty of Architecture and the Department of the History of Arts and Architecture. He is also a member of the American Academy of Arts and Letters.

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6. JOHN H. COOPER, Professor of Architecture and History of Art, is a member of the Faculty of Architecture and the Department of the History of Arts and Architecture. He is also a member of the American Academy of Arts and Letters.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

Although logging is not a major management program on the state-owned public forests of Illinois, commercial logging is an important influence on squirrel abundance on private lands and the Shawnee National Forest. Our research has concentrated on determining the effects of clear-cutting and selection cutting on squirrels.

Selection cutting, or the removal of individual or small groups of mature trees, is practiced on hundreds of acres of Illinois forestland each year and is often followed by removal of cull trees. We studied the short-term (1-2 years postlogging) response of squirrels to selection cutting without cull-tree removal on 3 hardwood tracts: 2 on the Shawnee National Forest and 1 on private land in Central Illinois. Logging removed 37%, 45%, and 55% of the basal area (a measure of density) of trees larger than 12 inches dbh on the 3 areas. Tree cavities suitable for sheltering squirrels were reduced on all study areas, 54% of those offering all-weather shelter and 29% of those offering escape only.

To relate the loss of food-producing trees to squirrel needs, we developed a crude stocking guide, which provided a minimum density for the principal squirrel-food producers larger than 10 inches in diameter. The guide is based on our information on squirrel food consumption in winter, average squirrel densities in Illinois (1-2 per acre in winter), and average tree seed yields in the Midwest. If we use our 3 study areas as an indication of postcutting food abundance, areas 1 and 3 apparently had an adequate number of trees producing seed whereas area 2 was short of oaks and black walnut (Table 1). Fortunately, area 2 also supported 4 beeches, 7 red oaks, and 2 sugar maples per acre--species also known to supply food for squirrels.

Selective logging had no apparent effect on squirrel densities, breeding rates, or the annual survival of marked adult males. Recovery rates for marked adult females were significantly reduced ($P < 0.025$) the year of logging when >40% of the merchantable volume was cut, but recovery rates of marked adult females increased to precutting levels the first year after logging. More squirrels were captured after logging than before logging on all 3 areas, possibly due to increased foraging by squirrels in logged areas. Adult male fox squirrels avoided the centers of the logged areas whereas gray squirrels were attracted to the cuts.

In a selection cut, if a minimum number of trees >25 cm dbh with a species mix close to that shown in Table 1 is retained, they should provide sufficient storable tree seed to maintain densities of 1-2 squirrels per acre. Trees to be retained should be selected during falls of good seed years so that only proven seed producers are saved. A good species mix will also minimize the effects of any seed failures due to late spring frosts.

Food supplies for squirrels should improve on our study areas. The increased light, water, and nutrients available to the residual trees should increase seed production beginning 2-5 years after logging. Squirrel numbers were not reduced by removals of up to 55% of the basal area of merchantable trees, at least for 1-2 years after logging, but removals greater than 40% of the merchantable volumes may be expected to reduce the number of breeding females the year of logging.

The first part of the paper is devoted to a discussion of the general principles of the theory of the structure of the atom. It is shown that the structure of the atom is determined by the laws of quantum mechanics, which are based on the principle of the conservation of energy and the principle of the conservation of momentum.

The second part of the paper is devoted to a discussion of the experimental results obtained in the study of the structure of the atom. It is shown that the experimental results are in good agreement with the theoretical predictions of the theory of the structure of the atom.

The third part of the paper is devoted to a discussion of the applications of the theory of the structure of the atom. It is shown that the theory of the structure of the atom has many important applications in the field of physics and chemistry.

The fourth part of the paper is devoted to a discussion of the future prospects of the theory of the structure of the atom. It is shown that the theory of the structure of the atom has many important future prospects in the field of physics and chemistry.

The fifth part of the paper is devoted to a discussion of the conclusions of the paper. It is shown that the theory of the structure of the atom is a very important and interesting field of research.

The sixth part of the paper is devoted to a discussion of the references. It is shown that the theory of the structure of the atom is a very important and interesting field of research.

We examined the impact of intensive cull-tree removal on tree cavity abundance on 4 areas on the Kaskaskia Experimental Forest in Hardin County, Illinois. In 2 mixed-hardwood stands totaling 25 acres, an average of 54 cull trees and other trees of no commercial value per acre was removed; in 2 comparable stands totaling 37 acres, no cull trees or other trees of no commercial value were removed. Periodic selection cuts had removed an average of 30 trees from each area. We found a 8-fold difference in the number of tree cavities between treatments (cull removal); treated stands averaged only 1 cavity per acre and untreated stands averaged 8 cavities per acre. Thus, wherever cull-tree removal is practiced, some trees containing cavities should be retained for wildlife use.

For gray squirrels, we believe that retention of 2-4 trees with suitable cavities per acre is a reasonable goal to use when planning selection cuts or cull-tree removal. Where fox squirrels predominate, perhaps as few as 1-3 cavities are needed, but sufficient cavities should always be retained to provide shelter for other wildlife species that nest and shelter in tree cavities. In Illinois, black oak, sugar maple, basswood, cottonwood, beech, and elm readily form cavities and, if present, should be favored for present and future cavity formation.

We used 2 200-acre study areas in Ohio to determine the initial (1-2 years postcutting) response of gray squirrels to clear-cutting. Four additional small clear-cuts 7-9, 15-17 (2 acres) and 20-22 years old were used to determine squirrel presence and squirrel food production on clear-cuts up to 22 years old. Captures of gray squirrels declined 51.5% and estimated densities declined 44% in the 1st year following clear-cutting of 32 acres of a 206-acre forest. Recovery rates for tagged adult squirrels whose home ranges included the clear-cut were lower than rates for adults not exposed to clear-cutting. Fewer than 20% of the adults known to be living adjacent to a clear-cut were captured within the cut area. In a companion study of 2 smaller, narrower clear-cuts (20 acres and 9 acres) on a 188-acre hardwood forest, no significant changes in squirrel densities, recovery rates, breeding rates, movements, or body weights were observed after clear-cutting. On these and other clear-cuts 7, 15, and 20 years old, squirrels ventured significantly farther into the clear-cuts during winter than after leaf-out. Clear-cuts <22 years old contained less ($P < 0.001$) food for squirrels than uncut forests. Squirrels using clear-cuts <22 years old were considered to be transients; however, gray squirrels foraged significantly farther into 15- and 20-year-old clear-cuts than into a 7-year-old clear-cut.

In considering a size limitation on clear-cuts to benefit squirrels, we use the home range of the adult female as a guide because adult females are more sensitive to habitat changes than adult males. Clear-cuts narrower than 500 feet should allow most squirrels to retain some portion of their original home range.

The length of narrow clear-cuts will be determined by site-class differences, topography, logging constraints, or conflicts with travel and stream protection zones. If cutting units exceed 20 acres, we recommend retention of uncut travel lanes of mature trees, 50-100 yards wide, to permit squirrels and other wildlife to cross clear-cuts. These travel lanes would be required for about 30 years after cutting to allow trees within clear-cuts to reach seed-producing age.

The first part of the paper discusses the importance of the study and the objectives of the research. It also mentions the scope of the study and the limitations. The second part of the paper discusses the methodology used in the study. It mentions the data sources and the statistical methods used. The third part of the paper discusses the results of the study. It mentions the findings and the conclusions. The fourth part of the paper discusses the implications of the study. It mentions the policy implications and the future research. The fifth part of the paper discusses the conclusion. It mentions the main findings and the recommendations.

The study was conducted in a systematic and rigorous manner. The data was collected from a large sample of respondents. The statistical methods used were appropriate for the data. The results of the study are presented in a clear and concise manner. The findings of the study are discussed in detail. The implications of the study are discussed in detail. The conclusion of the study is presented in a clear and concise manner. The main findings of the study are summarized. The recommendations of the study are presented.

The study has several strengths. It is a large-scale study. It is a longitudinal study. It is a quantitative study. It is a qualitative study. It is a mixed-methods study. The study has several limitations. It is a cross-sectional study. It is a self-reported study. It is a non-experimental study. The study has several contributions. It contributes to the knowledge of the field. It provides evidence for policy-making. It provides evidence for practice.

Clean-up crews frequently cut or kill those trees <2 inches dbh left by the loggers. They often remove such food producers as flowering dogwood, hornbeam, and hophornbeam that produce the only reliable foods for squirrels during the 1st years of regrowth. We recommend that as many seeding-age stems of these understory species as possible be retained in new clear-cuts.

Thus, with certain constraints, neither selection cutting nor clear-cutting will drastically reduce squirrel numbers. Next month we will discuss management of Illinois' forests to increase oaks and hickories, the principal food species for squirrels in Illinois.

Table 1. Postcut abundance (No./acre) of squirrel-food producers on each study area. The minimum number of trees ≥ 10 inches dbh is based on the average amount of seed produced by each species and the number of seeds eaten by a squirrel in winter (October-March).

	White oak	Black oak	Black walnut	Mockernut hickory	Shagbark hickory
Area 1	9	7	<1	11	<1
Area 2	1	1	<1	5	3
Area 3	9	2	6	2	4
Minimum number of trees ≥ 10 inches dbh desirable	5	7	1	4	6

Responses of Prairie Chickens to Habitat Manipulation-W-66-R

R.L. Westemeier,
J.W. Buhnerkempe

A substandard nesting effort, i.e., too few nests and too few hatches (despite hatch success of 50%), appears central to the predicted population decline of at least 32% for this coming spring at Bogota (MWRL 23(12):3). In addition, an observable adverse trend is a definite decline in hatchability of prairie chicken eggs at Bogota. By plotting a 5-year moving average for the years 1963-80, we found the average hatched nest produced at least 1 less chick since 1974 than during 1963-72. Both clutch size ($\bar{X} = 11.7$, range 10.4 - 13.1 eggs) and percentage fertility ($\bar{X} = 89.2\%$, range 80.2 - 100.0%) have been relatively stable over the same 18-year period. Thus, embryonic mortality, not infertility, is the cause for the decline in egg hatchability. Possible causes for the increase in embryonic mortality may be due to adverse changes in (1) the genetic quality of the population, (2) the hen's physiological condition, or (3) the environment of the egg before and during incubation (Romanoff and Romanoff 1949. The avian egg. John Wiley and Sons, Inc., New York.), or some combination of these factors. Altered behavior of nesting hens, such as reduced attentiveness during incubation due to harassment by pheasants, may be a major factor in No. 3. Pheasants may also cause the increased nest desertion noted at Bogota (MWRL 19(8):3-4).

The first part of the report deals with the general situation of the country and the progress of the work during the year. It is followed by a detailed account of the various projects and the results achieved.

The second part of the report deals with the financial statement of the year. It shows the income and expenditure of the organization and the balance sheet at the end of the year.

The third part of the report deals with the administrative matters of the organization. It includes a list of the members of the organization and a list of the committees and sub-committees.

The fourth part of the report deals with the future plans of the organization. It includes a list of the projects to be undertaken in the next year and a list of the resources required for these projects.

The fifth part of the report deals with the conclusions of the year. It includes a list of the achievements of the organization and a list of the lessons learned from the experience.

The sixth part of the report deals with the recommendations of the organization. It includes a list of the suggestions for the improvement of the organization and a list of the actions to be taken.

The seventh part of the report deals with the appendix. It includes a list of the documents and reports referred to in the main text and a list of the names of the persons who have contributed to the work of the organization.

The eighth part of the report deals with the index. It includes a list of the subjects and topics covered in the report and a list of the pages where they can be found.

The ninth part of the report deals with the bibliography. It includes a list of the books and articles referred to in the report and a list of the names of the authors.

The tenth part of the report deals with the conclusion. It includes a list of the main findings of the report and a list of the recommendations for the future.

Pheasants increased from an occasional crowing cock heard during 1963-68 to 27% of the combined populations of prairie chickens (68 cocks) and pheasants (25 cocks) at Bogota by 1979. Pheasant nests increased from none found during 1963-68 to 31% of both prairie chicken nests (27) and pheasant nests (12) found in 1980. From 1 to 6 crowing cock pheasants have been present in recent years on each of the 7 sanctuary units at Bogota. Harassment of chickens on their leks (booming grounds) by pheasants and parasitism of chicken nests by pheasants have been frequently described in previous reports. We now note that (1) reduced nesting effort, particularly in 1977 and 1980, (2) increased nest abandonment, and (3) reduced hatchability also coincide roughly with the establishment of pheasants on the Bogota Study Area.

The case against the pheasant gains additional credence by considering recent changes in flock status in Marion County where pheasants are not (yet) established. Prairie chickens at Bogota increased 35% between the springs of 1979 and 1980 to an average level of nearly 92 cocks. However, the flocks near Kinmundy and Farina in Marion County increased 60% during the same period to the highest count (64 cocks) on record (MWRL 23(4):2-3). Even the unmanaged flock near Hoyleton in Washington County (also no pheasants present) increased from 4 to 7 cocks (+ 75%) between 1979 and 1980. In contrast to the predicted decline in Jasper County of at least 32% for this coming spring, flocks in Marion County should be relatively stable, according to our preliminary booming ground surveys.

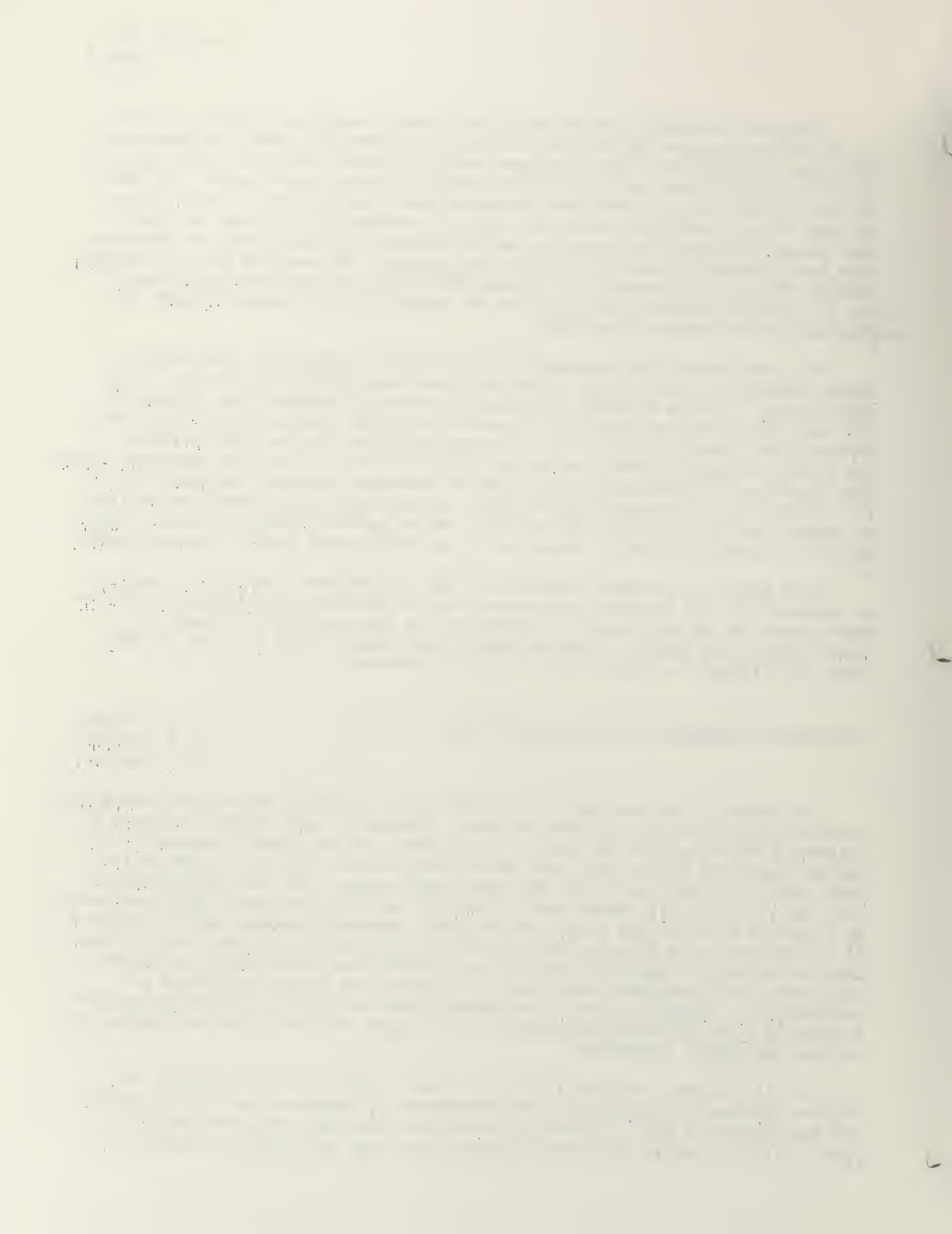
Such factors as weather conditions, land-use patterns, population density on sanctuaries, and genetic polymorphism are, or seemingly should be, similar in both Jasper and Marion counties. Pheasants are the one factor, present in Jasper County and absent in Marion County, that keeps coming to light as "bad news" for Illinois' primary flock of prairie chickens.

Ecology and Management of White-tailed Deer - W-87-R

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

The range of the deer herd in Illinois has been expanding and the population increasing over the last 25 years or more. Presently, deer occupy virtually all suitable habitat and can be found in every county in the state. Because little further expansion of the deer herd can be expected and habitat is continually being lost, the state deer herd may soon reach a peak. The similarity between 1979 and 1980 gun kills under similar hunting conditions suggests this conclusion. As a peak is attained and demands on the deer resource increase, careful control of the harvest while allowing optimum use of this resource becomes more critical than in the past. However, detailed field studies and experimental management strategies are beyond the budget and time constraints of the Department of Conservation. Computer analysis of harvest data and simulation modeling provide a feasible means of evaluating current herd trends and predicting the outcome of various management strategies.

We will approach this analysis in 2 steps. First, we will evaluate deer harvest information collected by the Department of Conservation. Since opening the deer season in 1957, successful gun hunters have been required to bring their kill to a county check station where sex, age, and other information are



recorded. From this information we will attempt to develop a suitable model for predicting herd size for the following season so that hunter quotas can be accurately set. Secondly, available data on harvest, reproduction, mortality, and similar information will be used in a simulation model to answer "what if" types of questions, such as what would happen if the number of hunters in a region substantially increased. Next month we will describe the techniques used in evaluating harvest data and the numerous biases encountered when using this type of data.

Cooperative Waterfowl Research - W-88-R

F. C. Bellrose,
S. P. Havera,
G. A. Perkins,
H. K. Archer

"Where are all the ducks?" was a question often asked by perplexed and frustrated duck hunters, researchers, and journalists during the 1980 waterfowl hunting season, one of the poorest in memory. Weekly aerial waterfowl censuses conducted by Robert Crompton from September through December revealed that the number of ducks in both the Illinois and the central Mississippi River (Grafton to Rock Island) valleys ran higher in 1980 than in 1979 until the 1st week of October. Then the normal fall buildup of birds in the valleys slowed until by the 3rd week of November there was only one-third as many birds in the Illinois Valley and one-half as many birds in the central Mississippi Valley as were observed during the same week of 1979. A similar trend was noted in the lower Mississippi Valley (Cairo to Grafton) and selected cooling lakes and reservoirs in central and southern Illinois. Totals for 3 biweekly censuses were only one-third of the 1979 numbers on comparable flights.

Numbers of ducks in the Illinois Valley peaked at 1,256,000 during the 1st week of November in 1979. The 1980 peak of 544,000--a 57% decrease--came approximately a week earlier. For further comparison, our highest peak count in the Illinois Valley was 1,349,000 on 29 November 1978. The central Mississippi Valley peak numbers were 1,459,000 and 948,000 for 1979 and 1980, respectively--a decrease of 35%. A 70% decrease in peak population numbers from 326,000 in 1979 to 99,000 in 1980 was documented for the lower Mississippi Valley and the selected lakes and reservoirs of central and southern Illinois.

Contrary to duck populations, Illinois River valley Canada and snow goose populations peaked at higher levels in 1980 than in 1979. In the central Mississippi River valley, numbers of both species were down slightly in 1980 from 1979. Population peaks are misleading in this case because counts for both species and both rivers were substantially lower each week after mid-October than for corresponding weeks of 1979. The biweekly censuses of the lower Mississippi Valley and scattered central and southern Illinois lakes revealed fewer geese throughout the 1980 season compared with 1979.

Several factors caused the shortage of ducks during the past waterfowl season. Populations were lower because of a poor hatch of young on the breeding grounds. Also, abnormally heavy precipitation in the prairies of the Dakotas and Saskatchewan during late summer caused flooding which increased the availability of natural foods to ducks. These extra food resources, combined with relatively mild weather, held the birds farther north during our hunting season. We hope that the late summer precipitation on the breeding grounds will be conducive to a good hatch this spring so that more typical numbers of ducks will wing their way through next fall.

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

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Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

February, 1981

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Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

August brood counts of pheasants on the Ford County Management Unit (FCMU) are often incongruent with other predictors of pheasant abundance: spring breeding population index (SBPI), projected hatch of chicks from all nonrow-crop cover, and fall hunter harvest data. For example, from 1975 to 1977 the numbers of hatched nests were projected at 160, 162, and 44, respectively; counts of broods per 100 miles in those years were 54.4, 29.4, and 26.9, respectively. A reliable indicator of abundance has been the SBPI, from which we have been able to predict ($r = 0.98$, $P < 0.01$) the hatch of chicks from all nonrow-crop cover on the FCMU since 1973.

August brood counts have tended to differ with other indices of abundance in years when the projected hatch from all nonrow-crop cover declined at least 50% from the previous year (1975 and 1977) or increased over the previous year (1979 and 1980). Variation in counting conditions (weather) may have contributed to the inconsistency of the brood counts. Brood counts on the FCMU are probably a less reliable index to recruitment than other indices and less reliable than brood counts on unmanaged areas. On the FCMU, comparable numbers of broods have been observed along both mowed and unmowed roadsides.

Brood counts may be more reliable in years when most of the hatched nests are found in nonroadside habitat than in years when most of the hatched nests are found in roadside habitat. The number of broods observed per 100 miles (1973-80) correlates highly with the number of hatched nests in nonroadside habitat ($r = 0.86$, $P < 0.01$) but apparently is inversely related to the proportion of hatched nests in roadside vegetation. Fewer broods were observed in years when most of the hatched nests were found on roadsides ($r = -0.59$, $P \approx 0.10$), regardless of the density of breeding pheasants. Thus, August counts of broods hatched on roadsides may be biased in some years.

The hypothesis that brood counts on roadsides are unreliable is consistent with the preliminary findings of a study of 6 radio-monitored broods hatched on managed roadsides. These broods hatched in areas with neither hay nor oat fields nearby. After 2-3 days, the broods left the nest site and tended to move away from the roadside toward the middle of the section of land; subsequent radio locations of these hens with broods near roadside vegetation were rare. Previous radiotelemetry studies near Sibley indicated that broods hatched in forage legumes or in roadside vegetation near hay or oat fields tended to remain near the actual nest site (within .25 mile); these broods were frequently located in or near roadside vegetation as they moved to or from an oat field to forage for insects.

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These preliminary findings, if confirmed, have 2 important implications for management. First, August brood counts are not a reliable means of comparing trends in pheasant abundance in areas where nearly all roadsides are managed. Secondly, most broods that hatch on managed roadsides evidently forage for insects in other cover; therefore developed roadside vegetation may be of minor importance for brood rearing activities, even with abundant insects for foraging.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

Seeds of oak and hickory provide gray and fox squirrels with their staple diet in Illinois. Both oak and hickory are found over a wide range of sites, with best growth occurring on moist, well-drained soils in coves and on middle and lower slopes. Hickories are consistently present but are not generally abundant (<10% of the trees). Pure stands of hickory are invariably the result of past years of heavy and continuous pasturing by livestock.

The present unmanaged mixtures of oaks and hickories on both public and private lands in Illinois are generally just reaching the age of full seed production (50+ years) and can benefit from judicious thinnings and release cuttings. The recommendations that follow are taken from Sander (1977. USDA Gen. Tech. Rep. NC-37. North Central For. Exp. Stn.) and relate to the oaks, but because the silvicultural requirements of the hickories closely follow those of oak, the recommended treatments should benefit both genera equally well.

In previously unthinned stands, do not reduce tree density below 70 to 75% of full stocking and do not make large holes in the stand. Select proven seed producers for release cutting spaced as evenly as possible throughout the stand. Strive for a mix of species to guard against a seed crop failure. Release at least 5-6 white or bur oaks, black oaks, and hickories per acre. If you have a choice, remove red oak before black oak and bitternut hickory before other hickories--squirrels don't like either species and in the case of red oak acorns lose body weight in winter if forced to eat them exclusively. Remove intermediate and suppressed trees from around the crowns of trees to be released. Be sure and retain trees with cavities for squirrels and other wildlife that nest in cavities.

Recent pulpwood sales in Illinois indicate that markets for the products of such thinnings exist in the following counties: Northwest - Jo Daviess, Stephenson, and Carroll; West-Central - Peoria, Fulton, Mason, Cass, and Morgan; South-east - Edgar, Clark, Crawford, Lawrence, Richland, Jasper, Cumberland, Effingham, Fayette, and Wayne; South - Pope, Johnson, Union, Alexander, and Pulaski.

In the remaining counties, the recent boom in demand for firewood should provide a market for most tree species cut in thinning oak stands.

Responses of Prairie Chicken to Habitat Manipulation-W-66-R

R.L. Westemeier,
J.E. Buhnerkempe

Since 1973, declines in the prairie chicken population at Bogota were related to high rates of nest predation, declining hatchability, reduced nesting effort, and the adverse impact of the ring-necked pheasant (MWRL 19(8):3-4, 22(9):3, 23(12):3, 24(1):4). Another factor that may be impacting negatively on the Bogota flock is public visitation during booming season.

Over the past 15 years, a total of 4,544 visitors (including repeaters) spent 731 blind mornings observing the courtship ritual of the prairie chicken on booming grounds (leks). Data for these 15 years showed no significant correlations between the number of known disturbances by human and natural factors ($r = -0.483$), or the number of blind mornings ($r = -0.492$), and the number of nests found per hen seen on leks. Over the past 5 years, however, we have noted a relationship that may be cause for concern. In 1976 and 1978, the number of nests found per hen observed on leks at Bogota was high, whereas the number of blind mornings was relatively low (Table 1). Conversely, the years when the number of nests per hen was low (1977 and 1980), the number of blind mornings was high. The number of known instances that humans flushed birds per blind morning was stable from year to year, so the amount of human disturbance was related to the number of blind mornings for a given spring.

Booming prairie chickens are disrupted not only by humans but by avian predators, pheasants, and mammals. When the number of incidences of flushed birds per morning due to natural causes exceeded 1.0, the number of nests per hen dropped to low levels (Table 1).

The combination of prolonged bad weather (rain and high winds), persistent harassment by harriers and pheasants, and disturbances by the visiting public may be sufficient some years to delay or prevent mating and thus limit the nesting effort. We can do little about natural factors, but we can and should increase supervision and guidance of visitors. This spring we hope that the following changes will reduce disturbance to prairie chickens on their booming grounds:

1. Reduce the limit on observers from 20 to 10 per morning.
2. Alternate blind mornings among booming grounds.
3. Allow visitation only on 2 or 3 mornings per week instead of almost every morning.
4. Place more emphasis on blind etiquette, rules, and regulations.

Table 1. The effect of different levels of public visitation and disturbance of prairie chickens on booming grounds (leks) on the subsequent nesting effort at Bogota.

Year	Blind Mornings	Known Instances of Flushed Birds per Blind Morning ^a		Number of Nests Found per Hen Observed on Leks
		Harriers & Others	Human	
1976	46	0.3	1.2	0.9
1977	66	1.9	1.2	0.5
1978	26	0.6	1.2	1.1
1979	43	1.2	1.2	0.6
1980	54	1.4	1.3	0.4

^a A blind morning represents 1 booming ground under observation from 1 or more blinds for 1 morning.

Ecology and Management of White-tailed Deer - W-87-R

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

Numerous methods of analyzing hunter kill records have been proposed; many involve some form of life-table analysis. Modifications of 2 basic types of life-table analysis are being evaluated for use on the Illinois deer kill: cohort-specific and time-specific types. The cohort-specific life table uses kill records to follow the fate from birth to death of a group all born at the same time. The time-specific life table uses the age structure and sex ratio of the deer herd at a specific point in time. Unfortunately, these methods include assumptions seldom met by the deer-kill information available. The greatest deviation from the assumptions is our lack of an unbiased sample of the deer herd. Because of hunter selectivity, vulnerability differences among sex and age classes, failure of hunters to report the kill of certain sex and age classes, and aging errors at check stations, deer-kill information does not truly represent herd characteristics; male deer appear to be over-represented and fawns are under-represented in the recorded deer harvest. Another assumption, especially important in predicting herd dynamics, is that reproduction and survival are constant. Deer-kill information probably deviates less from this assumption in Illinois than in some northern states because Illinois winters are generally not severe and food is abundant.

The biases noted above can cause serious problems, especially in estimating herd size. However, if consistent in the same direction, the biases can be delineated by simulation techniques and reduced by mathematical methods.

Our concern with the deer harvest analysis is not so much the determination of deer numbers but the prediction of trends in the deer population so that harvest can be adjusted accordingly. In a future newsletter we will compare the ability of several techniques to detect trends.

Cooperative Waterfowl Research - W-88-R

F. C. Bellrose, S. P. Havera,
G. A. Perkins, H. K. Archer

Each year state and federal biologists and qualified volunteers across the nation brave the January weather to conduct the Winter Waterfowl and Eagle Survey by land, water, and air. This cooperative nationwide survey begins the first Monday of the year and is completed whenever local weather conditions permit during the following 4 days. This census serves as a rough index to yearly changes in the populations of ducks, geese, swans, coots, and bald eagles and also delineates their winter distribution.

In Illinois, Robert Crompton of the Havana Laboratory participated during January in the Winter Waterfowl and Eagle Survey by aerially censusing the Illinois and Mississippi River valleys and various selected reservoirs and cooling lakes throughout the state. Illinois winter censuses vary substantially from year to year because of weather; therefore we have compared the 1981 totals with 1976-80 5-year averages for evaluation.

Ducks surveyed in the Illinois River valley in winter 1981 totaled 172,000, a decrease of 17% from the 5-year average. Conversely, in the Mississippi River valley there were an estimated 162,000 ducks, a 15% increase over the 5-year average. Censuses of reservoirs and cooling lakes across the state revealed a 45% increase in birds in northeastern Illinois and a 30% decrease in the central and southern part of the state. The total number of ducks in the Illinois winter survey decreased 7% in 1981 from the 1976-80 average, a smaller reduction than might be expected from the low totals for fall 1980 (MWRL 24(1):6).

Twenty-three hundred Canada geese, 1,000 of which were the giant race, were observed on the Illinois River valley winter survey as compared to 24,000 on the Mississippi River. These totals represented a 72% decrease and a 65% increase, respectively, from the 5-year averages. Canada goose numbers were up slightly to 65,000 on the cooling lakes and reservoirs in central and southern Illinois and increased 10% statewide over the 1976-80 average. Few snow geese and insignificant numbers of coots have been censused in the 1976-81 winter surveys.

The 267 bald eagles counted in the Illinois River valley during the 1981 winter survey represented a 5% increase over the 1976-80 average. In the Mississippi River valley, bald eagle numbers were up 15% to 437 over the 5-year average of 380. Only small numbers of bald eagles disperse to cooling lakes and reservoirs in Illinois and contribute little to the statewide population.

The 1981 survey indicated a slight shift in the winter distribution of waterfowl from the 1976-80 average. Ducks and geese were more concentrated in the Mississippi River valley and less abundant in the Illinois River valley. The use of cooling lakes in northeastern Illinois by all species of waterfowl increased, whereas the cooling lakes and reservoirs in central and southern Illinois were used less by ducks and about the same by Canada geese.

Results from the Winter Waterfowl and Eagle Survey will provide a better understanding of population dynamics and distribution of the censused species.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

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Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Since 1972, 26 hen pheasants and 4 chicks have been captured near Sibley in spring and summer and fitted with a radio transmitter to monitor use of habitat and brood movements. Meaningful information has been generated for only 1 of every 3 hens captured, however, because of mortality, aberrant behavior, and limited radio reception. Unsuccessful attempts to monitor pheasant broods have been costly in terms of equipment, but more importantly in the loss of brood data.

We have reviewed our radiotelemetry and capture techniques to identify procedures that may minimize mortality and abandonment of nests or broods. Because hens were not randomly selected and sample size was small, data were ~~subjected to measures of association that do not assume a normal distribution.~~

Hens were captured and fitted with 16- to 34-g radio harnesses before incubating nests (May), during incubation (June or July), or while rearing broods (July or August). Two factors were identified, which, if controlled, may minimize nest or brood abandonment by hens after capture and release: length of time into incubation and weight of radio harness. For 9 hens captured on the nest, the frequency of abandonment apparently decreased ($r_{pb} = -0.06$; $P < 0.05$) as the days of incubation increased. Hens that successfully resumed and completed nesting or brooding activities after installation of the radio harness tended to have lighter radio packages ($\bar{X} = 25.0$ g) than unsuccessful hens ($\bar{X} = 28.8$ g). The difference in radio weights among the 2 groups was significant, $P < 0.05$. Hence, it is possible that radio weight limits the success of nesting and brood-rearing attempts in progress at the time of capture. Next month we will consider factors which affect the survival of radio-monitored pheasants.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

Increasing the percentage of oaks and hickories in new or existing forests is not an easy job. Many existing stands are not reproducing themselves. The concurrent practices of heavy cutting, fire, and pasturing, so common in past years, apparently favored oak and hickory production; with the abandonment of these practices, the oaks and hickories are being replaced by more shade-tolerant, moisture-loving species such as sugar maple.

On commercial forest lands, where timber production has 1st priority, clear-cutting has been found to reproduce hardwoods of good quality. However, oaks and hickories will not be a significant part of the new stand unless there is sufficient advance reproduction in stems >4.5 feet tall before cutting. Midwest foresters have concluded that when an adequately stocked oak stand reaches a mean stand diameter of 3 inches, there will be a 30% stocking of dominant and codominant oak trees averaging 4.5 inches in diameter. For wildlife, we believe that a 10% stocking of hickory is also desirable.

Wildlife managers should use the following procedures to evaluate the existing understory stocking of oaks and hickories before contemplating clear-cutting. Computations have shown that the minimum area requirement for one 4.5-inch tree is 0.00136 acre. Therefore for 30% stocking, $221 (1 \div 0.00136 \times .30)$ oaks are required; for a 10% stocking of hickory, about 75 stems per acre are required. Because about 50% of the advance reproduction will die, the actual tally must be doubled to 440 oak and 150 hickories >4.5 feet tall per acre. Stump sprouts may be considered in the inventory if there is insufficient advance reproduction. Different species vary in sprouting ability; in addition, there is a variability within each species according to parent stem size (Table 1).

The inventory requires 2 sizes of sample plots, 1 to ascertain the amount of advance reproduction and the other to inventory the number of oak and hickory sprouts expected after cutting. For determination of advance reproduction, the plot size is 1/735 acre (4.3-foot radius). This odd size is used because a 4.5-inch-diameter tree takes up 1/735th part of an acre. (A fully stocked acre would contain 735 trees with an average diameter of 4.5 inches.) For 30% stocking of oaks (440 stems), 60% of the plots must be stocked with at least 1 stem >4.5 feet tall. For 10% stocking of hickory, 20% of the plots must be stocked. The number of plots needed for the inventory is shown in Table 2.

The size of sample plots needed to inventory the expected number of sprouts is 1/20-acre (26.33-foot radius). All oak and hickory trees >1.5 inches dbh are to be inventoried by species and size class. At least 10, 1/20-acre samples are required, but the number varies according to the size of the stand. Uniformity of stocking should also be considered.

To determine if the percentage stocked equals or exceeds 60% for oaks and 20% for hickories, divide the number of stocked plots by the total number of plots. If the percentage is less, calculate the number of stump sprouts required per acre to make up the needed percentages as follows: for oak, $5.06 \times (60 - \text{computed percentage of stocked plots})$; for hickory, $5.06 \times (20 - \text{percentage of stocked plots})$.

If sufficient oak and hickory reproduction alone or in combination with stump sprouts are present, the stand may be clear-cut with an assurance that oaks and hickories will be well represented in the new forest. If oak and hickory advance reproduction does not meet the standards outlined above, harvest clear-cutting should be delayed until advance reproduction builds up in the stand. Unfortunately, the cultural techniques are not well known for either genera, but crown development can be enhanced by periodic thinnings. Do not reduce overstory density below 70% of full stocking. It may take 10 to 20+ years before advance reproduction reaches the necessary size and density to permit clear-cutting.

Table 1. Expected percentage of oaks and hickory stumps that will sprout after cutting.

Size class (inches)	Black oak	White oak	Shagbark hickory
2 - 5	85	30	100
6 - 11	65	50	90
12 - 16	20	15	50
17+	5	0	25

Table 2. The number of 1/735-acre plots required to inventory understory stocking.

Size of forest (acres)	Number of plots
<10	25
10 - 30	40
30 - 50	60

Responses of Prairie Chickens to Habitat Manipulation-W-66-R

R.L. Westemeier,
J.E. Buhnerkempe

We see no reason to change our prediction of a decline of at least 32% in the number of prairie chicken cocks at Bogota this spring (MWRL 23(12):3). Why this decline at a time when recovery in the population, or even a 10-year cyclic high (which has currency in Wisconsin) should be evident? The prairie chicken population in Marion County (some 80 cocks) will be the highest on record (since 1964) and surpass the Bogota flock (Jasper County) for the first time in 14 years, although sanctuary acreage in Marion County (640 acres) is roughly one-half that in Jasper County (1,001 acres).

Fortunately, pheasants are not yet present in Marion County near Kinmundy or Farina. The process of competitive exclusion by pheasants may be the single most significant difference among the decimating factors common to both populations.

The number of hatched prairie chicken nests found at Bogota since 1969 was negatively correlated with both (1) the percentage of pheasant cocks in the combined populations of prairie chickens and pheasants ($r = -0.757$, $P < 0.01$) and (2) the number of pheasant cocks ($r = -0.693$, $P < 0.01$). The number of chicken nests found was also negatively correlated with the percentage of pheasants in the combined populations. These relationships suggest that pheasants may be limiting the nesting effort by prairie chickens at Bogota. Actual competition between pheasants and chickens for nest sites has not been observed but the preceding correlations suggest its occurrence. Twenty instances of nest parasitism have been recorded and harassment of chickens on their leks (booming grounds) by pheasants has been documented at Bogota. Increased abandonment of prairie chicken nests, reduced hatchability of eggs, increased mortality of young chickens, and interbreeding are also possible negative interactions between the 2 species, but so far, these factors are not well documented as being caused by pheasants.

Two other factors may be part of the problem at Bogota: (1) disturbance of prairie chickens by the public visitation program each spring (MWRL 24(2):3-4) and (2) a high level of nest predation since 1973. However, the predominant factor at Bogota apparently is the ring-necked pheasant. Effective control is needed, but any control measure must consider local public sentiment, which favors the pheasant. Trapping and transplanting of pheasants to Sam Parr State Park may be one approach to control. Such an effort would, theoretically, keep the birds in Jasper County on an area where they may be legally hunted. Trading pheasants from Bogota for wild turkeys from Missouri or ruffed grouse from Kentucky may also have merit.

Ecology and Management of White-tailed Deer - W-87-R

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

Since 1957 successful gun hunters have been required to bring their deer to county check stations to record such data as sex, age, and location of kill. Sex and age ratio data from 1 year can be used in a series of life table equations to predict deer herd size the following year. These predictions may not be accurate because harvested deer are often aged incorrectly and sex and age ratios in the harvest may differ from those in the wild because of variable susceptibility to harvest by different sex and age classes. If these biases are consistent in the same direction, however, trends in population size may be predicted.

From sex and age ratio data, we evaluated trends in deer population in 15 west-central Illinois counties (Region 3, Table 3). Predicted deer kill indicates a general upward trend in deer population. To prevent problems associated with over- and underexploitation of our deer resource, management agencies need to be able to control herd size; the most feasible means is by controlling hunter harvest. The relationship between number of deer harvested (dependent variable) and the predicted number of deer and number of hunters (independent variables) can be determined by the following equation:

$$1/Y = 8.177 \times 10^{-3} - 2.241 \times 10^{-7}X_1 - 2.249 \times 10^{-7}X_2$$

Y = Deer kill

X₁ = Numbers of hunters

X₂ = Estimated number of deer

with an $r^2 = 0.92$. Desired levels of harvest can be maintained through use of this equation. Extension of this basic equation to include other variables affecting the population dynamics of the white-tailed deer and its harvest will be evaluated in the future.

Table 3. Deer kill analysis, Region 3.

	Number of Hunters	Estimated Number of Deer	Predicted Kill	Actual Kill	% Error
1970	9,545	4,569	1,993	2,007	- 1
1971	10,671	7,852	2,483	2,432	2
1972	11,801	7,253	2,558	2,489	3
1973	12,168	8,926	2,897	3,078	- 6
1974	12,633	9,783	3,169	2,986	6
1975	15,233	8,048	3,376	3,405	- 1
1976	14,619	9,468	3,595	3,396	6
1977	15,121	9,305	3,696	3,320	11
1978	15,262	10,185	4,038	4,172	- 3
1979	13,911	10,104	3,575	3,749	- 5
1980	14,011	8,929	3,291	3,908	-16
1981		9,528			
					$\bar{X} = 5$

Cooperative Waterfowl Research - W-88-R

F. C. Bellrose, S. P. Havera,
G. A. Perkins, H. K. Archer

Weekly aerial censuses of waterfowl in the Illinois and Mississippi river valleys have been made every fall and numerous springs since 1948. As many as 64 different areas in the Illinois Valley between Coal City in the north and the river's confluence with the Mississippi River in the south have been covered. The Moline to St. Louis segment of the Mississippi River valley includes coverage of 38 locations in Illinois, Missouri, and Iowa. Seven additional areas between St. Louis and Cairo have been censused at 2-week intervals throughout each winter since 1972. Biweekly winter census flights of 10 lakes in central and southern Illinois and 21 smaller lakes in north-eastern Illinois were initiated in 1972 and 1976, respectively, to complete the coverage of most of the major waterfowl concentration areas in the state. Goose management areas in southern Illinois are censused by Department of Conservation personnel. Participation of Illinois Natural History Survey personnel in the Winter Waterfowl and Eagle Survey (MWRL 24(2):5) began in 1950.

Various bodies of water, including river channels, reservoirs, strip mine lakes, drainage ditches, bottomland and glacial lakes, and power plant cooling lakes, comprise the waterfowl census areas. Twenty locations are designated waterfowl refuges managed either by the federal government or by Illinois, Iowa, and Missouri.

Duck species observed during the 33 years of aerial waterfowl counts include 8 dabblers, 4 bay divers, 7 sea ducks, and American coots. Three species of geese have occurred with varying frequency in the census areas. Numbers of such rare or uncommon species as bald eagles, double-crested cormorants, pelicans, common loons, and 2 species of swans have also been recorded.

From this wealth of data we expect to answer many questions about population dynamics, migration, and seasonal distribution of waterfowl in Illinois. The acquisition of a 4051 Tektronix computer terminal at the Havana Lab will allow intensive analyses of these censuses. The data are currently being stored on cartridges for eventual analyses using various graphic and statistical packages.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

April, 1981

Vol. 24, No. 4

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

The reproductive success of 26 hen pheasants fitted with radio transmitters was reported last month (MWRL 24(3):1). This month we consider the survival rate of radio-equipped pheasants.

To examine the relationship of radio weight to survival for all 26 hens, the 2 variables, longevity and radio weight, were scored separately because only estimates were available in some cases. Hen pheasants surviving more than 3 months generally were equipped with radio packages weighing less than 27 g (the approximate weight of a pheasant egg); $r_{tet} = -0.71$, $P = 0.01$.

To predict survival (Y) from the ratio (X) of radio weight to body weight (i.e., radio package weight as a percentage of body weight), a regression analysis was performed for 15 hens captured prior to or after incubation. Longevity information available for this subsample was relatively accurate. The ratio for these 15 hens ranged from 2.3 to 3.3; the correlation of X with log Y was significant, $r = -0.68$, $P < 0.01$.

The predicted survival in days for the minimum observed ratio of 2.3 was 229 ± 111 , approximately 30 to 60 days shorter than the average longevity of hen pheasants studied on the Sibley Study Area. Hence, it is possible that pheasants equipped with radio packages weighing 2 to 3% of their body weight--an unusually low ratio compared with other radiotelemetry studies--have a lower survival rate than pheasants not equipped with radios. Our data further indicate that hen pheasants equipped with radios heavier than the normal weight of an egg have little chance of successful reproduction or survival beyond 3 months.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

A stand of timber can be clear-cut if it has adequate advance oak and hickory reproduction (see MWRL 24(3):1-2 for methods used to inventory advance reproduction). Oaks will be well represented in the new forest. When a stand is about 20 years old, thinnings can be used to select good seed producers and promote full crown development to maximize seed yields. Do not thin stands below 60% of full stocking so that the residual trees can fully utilize the available space.

Although oaks will do well under this management program, hickories will not. Hickory seedlings and seedling sprouts grow more slowly than most other species, and on average or above-average growing sites, they are soon overtopped by more vigorous competition.

Our research has shown that a single release cutting will not result in increased height growth of suppressed hickory stems <15 years old in clear-cuts. Therefore, we recommend reserving a few suppressed hickory poles on each acre to be clear-cut. About one half of these trees will die the first few years after the canopy is removed, but the remaining trees will probably reach seed-bearing age in a dominant position. Nutritional studies with penned fox squirrels fed nuts of shagbark and mockernut hickories show that each acre should average about 1,800 sound nuts per year. (Adult fox squirrels eat about 10 hickory nuts per day in winter; 1,800 nuts are needed for 100% of the diet from October to March--180 days.)

Seed production studies for shagbark, pignut, and mockernut hickories indicate that 20, 13, and 12 trees, respectively, 12+ inches dbh are required to produce 1,800 sound seeds in an average year. Doubling this number of stems to allow for mortality would mean reserving 40 shagbark, 26 pignut, or 24 mockernut hickories per acre before clear-cutting.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R.L. Westemeier,
J.E. Buhnerkempe

This spring prairie chickens were censused for the 19th consecutive year near Bogota in Jasper County, near Kinmundy in Marion County, and near Mt. Erie in Wayne County. The count near Hoyleton in Washington County was begun in 1969. These 4 areas are the only known sites in 1981 still harboring native remnants of the millions of the pinnated grouse once distributed over at least two-thirds of Illinois.

The Bogota flock dropped from a near-average level of 92 cocks in 1980 to 70 cocks this spring, a decline of 24%. Fortunately, the population was on the high side of our predicted level of 63.4 ± 15 (MWRL 23(12):3 and 24(3):3). The count at Bogota has ranged from 40 cocks in 1963 to 206 cocks in 1972.

Near Kinmundy the population level jumped from 64 cocks in 1980 to 88 cocks this spring, the highest on record, and the 1st spring since 1967 that the count in Marion County exceeded that of Jasper County. The count at Kinmundy this spring was nearly double the long-term average of 45.5 cocks; the low point was 30 cocks in 1971. In contrast to the Bogota flock, the Kinmundy flock was well distributed over the 5 sanctuary units in Marion County.

The prognosis is bleak for the 2 unmanaged flocks. Near Mt. Erie, 4 cocks were found in 1980 but only 2 cocks were located this spring. The best remaining habitat, 50 acres of redtop-timothy seed meadow, was hayed after seed harvest in 1980 and then plowed in mid-April this spring.

Only 3 cocks were seen on the traditional lek at Hoyleton on 14 February 1981, and none could be found in the area on 31 March (peak of booming season in 1981) or on 15 April. Seven male chickens were present at Hoyleton in 1980. An unusually high incidence of coyotes and disturbance by humans appeared to be compounding the problem of poor habitat at Hoyleton.

Thus, both the Mt. Erie and Hoyleton prairie chickens are perilously close to extinction. By next spring, the wildlife resources of 2 more counties in the prairie state may be further impoverished by the loss of the prairie boomer. If one assumes a 50:50 sex ratio, Illinois has some 326 prairie chickens remaining--97% of them on or near the sanctuaries.

Ecology and Management of White-tailed Deer - W-87-R

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

It is often desirable to know, but difficult to measure, the number of individuals in a wild animal population. To get an accurate count of the deer in the Allerton Park area, a helicopter census was conducted 9 January 1981 while there was a 6-inch snow cover on the ground. The census covered approximately 1,130 ha (2,800 acres) of nonagricultural land along the Sangamon River between Monticello, Piatt County, and Hog Chute Bridge, 11.2 km (7 mi.) southwest of Monticello. Stands of coniferous trees were censused on foot immediately after an aerial search of the surrounding area. One other forested area was also censused on foot because fuel limitations precluded a census by helicopter.

A total of 66 deer were seen from the air. As many as 14 deer were seen in 1 group and 1 single deer was seen, but typically the deer were found in groups of 3 to 4 individuals. Another 16 deer were counted during the foot censuses. The total of 82 deer makes a population density of 1 deer for every 13.8 ha (34 acres) of nonfarm land. This population density in the Allerton Park area is believed to be large enough to sustain the population but not so large as to ravage the habitat.

The deer population will be censused again by helicopter in winter 1982.

Cooperative Waterfowl Research - W-88-R

F. C. Bellrose, S. P. Havera,
G. A. Perkins, H. K. Archer

Habitat conditions and food resources for waterfowl in Illinois have changed appreciably since 1939 when waterfowl populations were first monitored along the Illinois River. Not only have most of the original wetlands in Illinois been drained, but those remaining are being degraded by sedimentation. Waste grains fed upon by waterfowl in harvested fields are being reduced by more efficient combines and fall plowing. However, the establishment of state and federal refuges and the creation of flood control-recreation and power plant cooling lakes have provided new waterfowl habitat.

Such changes in the waterfowl habitat in Illinois raise a variety of unanswered questions. Have waterfowl populations shifted in Illinois to adjust to changing conditions? Has the state experienced any overall decline in waterfowl numbers? Have some elements of the mallard population moved to the Central Flyway?

By analyzing our spring, fall, and winter census records, we intend to determine whether duck populations in Illinois have shifted from such traditional areas as the Illinois and Mississippi river valleys to power plant cooling lakes or other newly created habitats. We will also compare the status of waterfowl in Illinois with that of the same species elsewhere on the continent and determine whether elements from the waterfowl population of the Mississippi Flyway have shifted to the eastern corridor of the Central Flyway.

As we analyze census data on ducks, we also intend to evaluate trends in winter Canada goose populations since the establishment of refuges in the southern part of the state.

To complete our evaluation of waterfowl populations in Illinois, we will examine the breeding numbers and their distribution for the following species: wood duck, blue-winged teal, mallard, and giant Canada goose. Illinois is an important breeding area for wood ducks and a minor breeding area for mallards, blue-winged teals, and rarely for other species of ducks. A large breeding colony of giant Canada geese is becoming established in Fulton County and in some other areas of Illinois.

The examination of population data for waterfowl in Illinois will be essential in developing future waterfowl management strategies.

MONTHLY WILDLIFE RESEARCH LETTER

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IN 8 1981 Department of Conservation and Natural History Survey, Cooperating

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Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

May, 1981

Vol. 24, No. 5

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

In 1968, 61 of the 65 farmers on the Ford County Management Unit (FCMU) agreed to allow the Department of Conservation (DOC) to seed their roadsides to brome-alfalfa, and they agreed to delay roadside mowing to 1 August annually. By 1978, only 44 of the original 61 cooperators on the FCMU remained.

Factors that influenced long-term adoption of the roadside program by these 44 initial cooperators were recently analyzed. Individuals were grouped according to the number of years in which they mowed early (prior to 1 August) from 1974 to 1979. Group classification was based upon 1974-79 records because early mowing increased after 1973. Three groups were defined: participants (adopters, no early mowing 1974-79), vascillators (mowed early 1 or 2 times 1974-79), and non-participants (discontinuants, mowed early 3 or more times 1974-79). The initial cooperators on the FCMU were divided among these 3 groups as follows: participants, approximately one-fourth; vascillators, nearly one-half; and nonparticipants, nearly one-third.

Some questions remain unanswered regarding how these group classifications generalize to farm operators who have become involved with the DOC's Roadsides for Wildlife Program since 1972. We know that the percentage of roadsides unmowed on the FCMU in 1979 and 1980 have been nearly identical to trends in delayed mowing observed for scattered roadside seedings (the FCMU is a block seeding), other block seedings, and volunteer cooperators (the cooperation of farmers on the FCMU was solicited). A partial comparison of these data was presented in MWRL 23(8):1.

Next month we will consider characteristics that distinguish participants (adopters) from other groups on the FCMU.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

Most private woodlands in Illinois are scattered tracts less than 100 acres in size. But as size of tract makes no difference to the silviculture of oaks and hickories, these species may be cultured in any sized woodlot. The important factors affecting the management of these woodlots for timber and wildlife are (1) the landowner's objectives and (2) the minimum size of cutting unit that is operable or saleable in the area where the woodlot is located. In addition,

most woodland owners in Illinois at least pay lip service to the idea of benefiting wildlife in any woodland management program.

Table 1 shows the minimum cutting intervals, using clear-cutting, for different rotation lengths for use in 20-, 40-, and 60-acre woodlots. Our squirrel research has shown that clear-cut openings <500 feet across do not seriously disrupt resident squirrels (the diameter of a 4-acre circle is about 471 feet). Also, in summer squirrels will not penetrate into a clear-cut much beyond 125 feet from the forest edge; in winter they will travel as much as 180 feet from the uncut forest. Thus we recommend that clear-cuts in these small woodlots be kept less than 4 acres in size and not sited adjacent to one another for at least 25 years. Current recommendations dictate removal of all woody stems >2 inches dbh in these clear-cuts. To benefit squirrels, up to 10 hickories 3 to 6 inches in diameter should be left standing in the clear-cut. An additional 3 to 6 cull trees/acre should be killed in place and left standing to provide shelter for wildlife.

The remaining stands not ready for clear-cutting or deferred from regeneration should be managed for seed production using thinnings as recommended in NWRL 24(2):2.

Table 1. Minimum clear-cutting intervals (in years) for different rotation lengths, cutting areas, and woodland areas.

Rotation length (years)....	20-acre woodland and rotation of (years)			40-acre woodland and rotation of (years)			60-acre woodland and rotation of (years)		
	60	80	100	60	80	100	60	80	100
Minimum cutting area (acres)	Cutting interval (years)								
2	6	8	10	3	4	5	2	2	3
3	9	12	15	4	6	7	3	4	5
4	12	16	20	6	8	10	4	5	6
5	15	20	25	7	10	12	5	6	8

From: Roach, B., and S. Gingrich. 1968. Even-aged silviculture for upland central hardwoods. USDA Agric. Handbook 355. 39pp.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R.L. Westemeier,
J.E. Buhnerkempe

Disturbances by the visiting public, persistent harassment by harriers and pheasants, and prolonged bad weather have, in some years, delayed or prevented mating by prairie chickens and resulted in substandard nesting. The implication

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or

of human interference showed a need for reducing public visitation and increasing supervision of visitors to the prairie chicken booming grounds (leks) (MWRL 23(12):3-4).

The number of blind mornings was reduced from 52 in 1980 to 30 this spring, and the number of visitors viewing the courtship activities dropped from 325 to 129. The result was that the number of visitor-free days per lek during the first 3 weeks of April increased from 5.3 in 1980 to 12.5 this spring. The number of known instances of humans flushing birds per blind morning decreased from the norm of 1.2 to 0.9.

The number of harrier attacks per hour was reduced from 0.7 in 1980 to 0.1 during the first 3 weeks of April. Also, the Illinois Cooperative Crop Reporting Service reported relatively mild weather with only 1.08 inches of precipitation at Newton and temperatures 7 to 10°F above normal for south-central Illinois during the peak of the courtship season. A negative factor is that pheasant numbers may be at an all-time high at Bogota, according to the preliminary census.

We would expect an increase in nesting effort by prairie chickens this year due to the low level of harassment on the leks and the relatively mild weather. However, the increasing pheasant population at Bogota may be highly detrimental to nesting prairie chickens this spring and in springs to come.

Ecology and Management of White-tailed Deer - W-87-R

C. M. Nixon,
L. P. Hansen,
J. E. Chelsvig

The 1981 deer captures in Allerton Park are summarized in Table 2 by age and sex. From 5 December 1980 to 19 March 1981, 22 deer were marked in or near the Park, approximately 27% of the total population of 82 deer (MWRL 24(4):3). In addition, 7 of the 23 deer marked in 1980 were seen in the Park area, making a total of 29 marked deer, or about 35% of the total population in the Park.

The relatively mild winter weather and greater availability of food made attracting deer to the bait more difficult in 1981. Deer visited bait sites only at irregular intervals and never established any consistent patterns. Therefore, it was difficult to choose nights on which to attempt captures.

A capture method that involves the use of a drop net will be tried in the future. This method has been used with great success in Indiana, and we believe it will be a useful supplement to the rocket net.

Table 2. Age and sex of white-tailed deer captured in Allerton Park in 1981.

Age	Sex		Total
	Male	Female	
Adult	1	6	7
Fawn	10	5	15
Total	11	11	22

Cooperative Waterfowl Research - W-88-R

F. C. Bellrose, S. P. Havera,
G. A. Perkins, H. K. Archer

The chronology of waterfowl migration varies among different regions of Illinois. Aside from the inherent differences in migrational behavior of the various species, the length of the state and the different types of regional habitat affect waterfowl migration chronology. Each species of waterfowl migrates over a period of 2 to 3 months in the fall with the chronology varying among years, resulting in differences of up to 2 weeks over a span of years. The chronology of spring migration, influenced by the variability of spring weather, varies appreciably throughout Illinois and among years.

Variations in chronology of migration by regions of the state make the establishment of hunting regulations difficult. Moreover, weather, water levels, and food conditions also add to the variables influencing local population levels.

Our objectives during this project are to evaluate regional differences by species in the chronology of migration within Illinois and to evaluate yearly differences by species and region in the chronology of migration. Our evaluations will be based on 40 years of census data.

We anticipate that the information derived from our analyses will not only contribute to our knowledge of waterfowl migration but will also aid in determining the most judicious time frame for the waterfowl hunting season.

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Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

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Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

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Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Individuals who have agreed to cooperate in roadside management on the Ford County Management Unit (FCMU) were classified as participants (adopters), vascillators, or nonparticipants, (discontinuants) according to their long-term mowing behavior. Participants comprised approximately one-fourth of the farm operators on the FCMU (MWRL 24(5):1). This group tended to delay roadside mowing through at least 1 August annually.

To identify group differences on the FCMU, a questionnaire, which covered 3 general categories, was administered to farm operators in 1978-79. The categories were: (1) attitudes and knowledge regarding wildlife, pheasant ecology, and use of roadsides, (2) personal and farm characteristics, and (3) perceived advantages of seeded roadsides as a farm innovation.

Compared with vascillators and discontinuants, participants tended to be younger ($\bar{X}$ = 41 years), had farmed for a shorter length of time ($\bar{X}$ = 18 years), farmed smaller parcels of land ($\bar{X}$ = 360 acres), and owned or were in the process of buying approximately one-half of the land farmed. Participants controlled less land than other groups.

Discriminant analysis was employed to describe group differences and to classify the type of farm operator who would most likely participate long-term in the Department of Conservation's roadside program. Participants as a group scored low on the scale indexing a wildlife-related value orientation. Apparently participation by these individuals was not related to wildlife values. However, participants scored high on knowledge of pheasant populations and pheasant management; they tended to welcome hunters, understood the habitat needs of pheasants, and believed that roadside management was beneficial to wildlife--although they were not convinced that wildlife nests in developed roadside vegetation.

The data suggest that the typical participant has found the roadside program to be tenable on the basis of (1) his knowledge of wildlife management, and (2) the advantage of participation to his farm operation. Vascillators and non-participants differ from participants in at least 1 of these 2 dimensions. These differences will be discussed in future newsletters.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

Wildlife managers and foresters must recognize that many of the oak-hickory forests present today on good sites (site index 75+) will be replaced by other species after cutting. In central and northern Illinois, ecological trends show that the new forests will be dominated by sugar maple, basswood, white ash, and black cherry. In southern Illinois, these species will be joined by tuliptree and beech. The number of oaks and hickories present in these stands will depend on the number of stump sprouts produced and the number of seedling sprouts ≥ 4.5 feet tall present prior to cutting.

The effectiveness of managing these new stands for squirrels will be in direct proportion to the number of oaks and hickories that can be brought to seed-bearing age in the dominant or codominant crown position. With many faster growing stems present, managers must begin release cutting around oak and hickory stems as early as age 5. Some stems may have to be released several times before age 30, the age when oaks and hickories usually begin seed production.

Another option would be to plant vigorous seedlings of such species as white and black oaks or black walnut the 1st growing season after cutting. Mortality of these seedlings will frequently exceed 50%, but by cutting competing vegetation, some of these seedlings should reach seed-bearing age.

Both release cutting and planting cost money. But rotation age for these stands is at least 80 years and without acorns and hickory nuts, squirrel, deer, and turkey densities and harvests will be drastically reduced. For example, published data indicate that stands dominated by sugar maple support only about one-half the number of squirrels that are present in oak-hickory stands of similar age and condition. If the cost of release cutting or planting, or both, is prorated across the life of the stand (80+ years) or only for the seed-bearing years (40+ years) and charged against the increased production of wildlife expected as a result of the presence of oaks and hickories (for example, squirrel harvests would double), the cost per animal would be low.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R

R.L. Westemeier,
J.E. Buhnerkempe

To better document interactions between pheasants and prairie chickens, increased efforts were made this spring to census the pheasant population on the Bogota Study Area. Our standard listening-stop route for prairie chickens is conducted during the 1st half of April and includes 32 1-minute stops, 1 mile apart over about 26 sections or 6,734 ha. The route is usually run twice each spring on calm, rainless mornings during the first 2 hours after daybreak. This coverage is often supplemented by more intensive checking of each sanctuary unit and by observations from blinds on several leks (booming grounds).

This spring an additional effort to census pheasants was made during late April and the first 3 weeks of May (peak crowing season). From 40 minutes before sunrise to 20 minutes after sunrise, on calm rainless mornings, the listening

time was doubled from the standard 2 minutes to 4 minutes. Special emphasis was placed on triangulating each crowing cock pheasant, especially on the sanctuaries.

We estimated 48 crowing pheasant cocks on the Bogota Study Area this spring--an all-time record, as predicted (MWRL 24(5):3). Past estimates of pheasant numbers at Bogota were undoubtedly conservative because the estimates relied on methods suited for locating booming prairie chickens. However, we believe that pheasant numbers in past springs did not approach the level present this spring. Prior to 1969 it was rare to see or hear a pheasant at Bogota. Since 1969, pheasants have increased steadily to a conservative estimate of 22 to 26 cocks in the springs of 1977, 78, 79, and 80; the actual number may have been 30 to 35 cocks.

Winter observations of the sex ratio of pheasants at Bogota revealed at least 2 hens per cock, therefore indicating a total population of about 150 pheasants. The prairie chicken population at Bogota included 70 cocks this spring. The sex ratio on prairie chickens is not well known, but cocks are believed to outnumber hens throughout the range of the species. We believe the 38 hens seen on the leks at Bogota this spring were close to the actual number in the population. Thus, pheasants now probably outnumber prairie chickens on the Bogota Study Area. This shift in species abundance portends dire consequences for the prairie chickens at Bogota.

Ecology and Management of White-tailed Deer - W-87-R

C.M. Nixon, L.P. Hansen,
J.E. Chelsvig, P.A. Brewer

Knowing what a deer eats is knowing what a deer is doing about 80% of the time. To learn how changing agricultural practices, as well as other environmental changes, affect the diet of white-tailed deer in Illinois, we have begun a study of deer food habits.

Thus far, 52 rumens from hunter- and road-killed deer have been collected from east-central and western Illinois and the contents examined. Analytical procedures were similar to those used by Korschgen and others (segregation, identification, and volumetric measurement of food items).

Although samples collected represent all seasons, our primary interest is the diet in winter when deer become hard pressed to find high energy foods. Twenty rumens were collected during November, December, and February (no samples were available for January). Five food types comprised 82.2% of the total identified volume for the 3-month period: corn (Zea mays), 43.1%; wild crab (Pyrus ioensis), 27.2%; multiflora rose (Rosa multiflora), 5.1%; moneywort (Lysimachia Nummularia), 4.0%; and red oak acorns (Quercus rubra), 2.8%. Major items in frequency of occurrence were corn, 75%; multiflora rose, 75%; coralberry (Symphoricarpos orbiculata), 65%; honey locust (Gleditsia triacanthos), 55%; noncrop grasses (Graminae spp.), 35%; and winter wheat (Triticum aestivum), 35%.

Some unusual items encountered were alfalfa weevil larvae, a carabid beetle, and the abdomen of a wasp. These were most likely ingested while the deer foraged on plants.

We are developing a permanent collection of histological slides of plant leaf epidermal material. This collection will aid in identifying small particles in rumen specimens and leaf epidermal fragments in deer fecal samples. Approximately 70 such samples have been collected, and analysis will begin soon.

Cooperative Waterfowl Research - W-88-R

F.C. Bellrose, S.P. Havera,
G.A. Perkins, H.K. Archer

For many species of waterfowl, Illinois is about midway between the breeding and wintering grounds. Illinois is located in the Mississippi Flyway and is also crossed by several migration corridors leading to such diverse wintering grounds as Chesapeake Bay, coastal South Carolina, Florida, Mobile Bay, Arkansas, Louisiana, and Texas. Large contingents of mallards make a major change in flight direction in the state. They fly southeastward from Saskatchewan to Illinois, then south or south-southwestward to wintering grounds in Arkansas and Louisiana.

Some waterfowl banding recoveries in the state have been studied for migration patterns; others, particularly of the less important species, have not. Visual observations and radar surveillance are other sources of directional information.

We plan to increase our knowledge of migration patterns through Illinois by analyzing banding recoveries of waterfowl tagged in Illinois, analyzing recoveries of waterfowl taken in Illinois but banded elsewhere (particularly delineating migration patterns for species banded in small numbers or not banded in the state), and by summarizing ground visual observations and pilot reports. We will also investigate records of radar surveillance of waterfowl migration. Although species cannot always be identified, credible deductions can often be made from time, speed, location, and flight direction of the radar targets.

To optimize waterfowl management, the migratory patterns of the many populations must be documented. Information we hope to gather on the corridors used by different waterfowl species in migrating through Illinois can be used to establish future refuges or developed areas, or both. Such knowledge would also assist management establish expenditure priorities for enhancing existing refuges and public shooting areas.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

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Glen C. Sanderson and Eva Steger, Editors

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Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

The characteristics of individuals who participate long-term (adopters) in the roadside management program on the Ford County Management Unit (FCMU) were noted last month (MWRL 24(6):1). This month we will consider the characteristics of vascillators and nonparticipants (discontinuants).

Vascillators, approximately one-half of the initial cooperators remaining on the FCMU (MWRL 24(5):1), tended to be older ($\bar{X}$ = 55 years), well-established operators who farmed relatively large acreages ($\bar{X}$ = 562). They were nondescript in terms of wildlife-related values and knowledge and tended to evaluate the roadside program from the perspective of their farm operations--i.e., as to whether it saved them time and money. Vascillators did not consider roadsides for wildlife to be cost-reductive. However, in those years when it was convenient, they cooperated with the program and delayed mowing. Over time, vascillators have developed positive attitudes toward roadside management for wildlife and toward the managing agencies. These positive attitudes imply that vascillators are approachable. If their knowledge of and interest in wildlife were enhanced--perhaps by newsletter--they might choose to delay roadside mowing for reasons other than to benefit their farm operations.

Nonparticipants, approximately one-third of the farmers on the FCMU, were moderate in terms of age (51 years) and farm size (491 acres). The data suggest that (1) these individuals highly value pheasants and other wildlife around the farm, (2) they are aware of declines in pheasant abundance in the last decade, (3) they attribute these declines to the wrong factors, (4) they view the roadside program as inappropriate for enhancing ringneck populations (they have not observed wildlife nesting in roadsides), (5) they see no advantage for participating in terms of their farm operation, and (6) they have discontinued. Nonparticipants appraised wildlife management agencies in Illinois lower than did long-term participants and vascillators.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

One phase of our research has dealt with clear-cutting, specifically how to minimize the effects of this practice on tree squirrels. Our recommendations were to keep clear-cuts small (<20 acres), narrow (<500 feet), and carefully

sited in forests where 40 to 60% of the stands were of seed-bearing age (>40 years old). These recommendations are adequate for forests where clear-cutting is only an occasional event, but for forests totally regulated for a sustained yield of forest products, such recommendations are shortsighted. They fail to consider the effects on wildlife populations of a forest entirely composed of <20-acre, even-aged stands. Such an arrangement is fine for some species, but for many other species, these small, scattered tracts are inadequate to perpetuate viable populations.

Rotation age (the years between clear-cuts) is usually 80-120 years in hardwood stands in Illinois. Mistakes made now in cutting these forests will persist well into the 21st century.

Unfortunately, the relationship between stand size and population viability is unknown for most wildlife species, including squirrels. We know that isolated woodlots <10 acres in size contain unstable populations of fox squirrels with wide seasonal fluctuations in squirrel numbers. In more extensive forests, squirrel dispersal traits and mobility make it difficult to determine the optimum stand size, if there is one.

Graber and Graber (1976. Illinois Natural History Survey Biological Note 97) found that the number of breeding-bird species increased directly with stand-size increase. They found, however, that the rate of adding new breeding species decreased after reaching approximately 40 acres. Forty-acre stands contained about 60% of the breeding birds expected in Illinois woodlands.

Accordingly, we believe our recommendation to keep clear-cuts <20 acres was too low for many species and that a suitable compromise lies somewhere between 20 and 40 acres, perhaps around 30 acres. We cannot expect to provide suitable habitat for all species on each 30-acre stand, but judicious placement of these 30-acre stands, after considering the condition of the whole forest, should provide suitable niches for a diverse fauna. We continue to recommend that cuts remain narrow to maximize edge, and that cuts not be sited adjacent to one another until seed production resumes, usually at 25 to 30 years.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R.L. Westemeier,
J.E. Buhnerkempe

The number of prairie chickens per square mile on Illinois sanctuaries is the highest recorded in the range of the species. The problem is that we have little more than 1 square mile of nest habitat annually in Jasper County and less than that annually in Marion County. Near Kinmundy and Farina in Marion County this spring (1981), the prairie chicken population was (1) the highest on record since censusing began in 1963 and (2) well distributed over the 5 sanctuary units there. Seventy-three of the 38 cocks in Marion County were located on or within 0.8 km (0.5 mi) of the sanctuaries. The density of chickens was 100 cocks per 2.6 km² (1 mi²) for the 189 ha of nest cover on the sanctuaries--a recommended goal in prairie chicken management (NWRL 23(7):3). The mean density for the 10-year period of 1971-80 for the Marion County sanctuaries was 67 cocks per 2.6 km² of nest cover.

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On sanctuaries near Bogota in Jasper County, the mean density of prairie chicken cocks has ranged from a low of 47 cocks per 2.6 km² of nest cover in 1968 to a high of 208.6 cocks per 2.6 km² in 1972. The average has been 106 cocks per 2.6 km² over the 14-year period of 1967 to 1980. By 1981 the density of chickens at Bogota had dropped to 65 cocks per 2.6 km². Only 39% of the sanctuary acreage (Yeatter-Field-McGraw and Donnelley-Walters units) contained 87% of the chicken cocks at Bogota. No chickens were located on or near the Mark 17 and Mark 40 acre units for the 5th consecutive year, only 1 cock each boomed on the 140-acre C. McCormick and 110-acre Galbreath sanctuaries, and 2 and 4 cocks boomed on the 222-acre Otis-Fuson unit and 30-acre J. McCormack tracts, respectively.

Pheasants must now be considered as a major factor influencing the density of prairie chickens that can be achieved at Bogota (MWRL 24(6):2-3). The record number of pheasants at Bogota this spring were distributed over all 7 sanctuary units in much better proportion to the available nest cover than was the case for the prairie chickens. Pheasants make heavy use of prairie grass while chickens show limited use of the rank stands of native grasses on the sanctuaries. These differences in distribution among sanctuaries and use of cover types between the 2 species will be the key factors considered in a pheasant trapping and removal effort being considered for this fall. Key considerations will be (1) maximizing trapping pressure on the pheasant, probably by nightlighting, while (2) minimizing disturbance to the prairie chickens by the trapping effort.

Ecology and Management of White-tailed Deer - W-87-R

C.M. Nixon, L.P. Hansen,
J.E. Chelsvig, P.A. Brewer

Changes in the landscape caused by corn and soybean harvests apparently did not trigger fall movements of deer away from the summer range (MWRL 23(11):3). Of 5 female deer that were radio-collared in January and February 1980, only 2 were observed to move away from the summer range. Of the remaining 3, 1 adult and 1 yearling were killed on the summer range by deer hunters during the shotgun hunting season, and the 3rd (a yearling whose transmitter failed after 1 month) has remained on the same range where she was captured, both winter and summer.

Both deer that left the summer ranges were adult females. One spent the summer 7.3 km (4.6 mi) northeast of her winter range. Her precise movements are unknown because her transmitter failed 1 week prior to the 1980 shotgun hunting season. However, she was observed a few times on her summer range immediately after the season opened. She was next seen March 1981 on her old winter range with 2 fawns, one of whom was marked in June 1980. This is an example of a true migration, but our information is incomplete because we know neither her present location nor the stimulus that caused her to move.

The other adult female presents a confusing case. In late September 1980, near the end of crop harvest, she went to her old winter range (Allerton Park) for 9 days and then returned for about 3 weeks to her 1980 summer range 4.8 km (3 mi) north of Atwood, Piatt County. She was next found on 26 October 11.2 km

(7 mi) south-southeast of Sullivan, Moultrie County. A few weeks later on 13 November she was located 8 km (5 mi) north of Effingham, Effingham County. This movement did not seem to be of any advantage to her. Possibly she became disoriented while being harrassed by breeding males and wandered there accidentally. Shortly after the close of the deer season, a pheasant hunter found her dead (apparently shot by a deer hunter) on a public hunting area near Lake Shelbyville in Moultrie County. She seemed to have been seeking an area on which to winter. For some unknown reason she rejected Allerton Park and moved to an area south-southeast of Sullivan.

Cooperative Waterfowl Research - W-88-R

F.C. Bellrose, S.P. Havera,
G.A. Perkins, H.K. Archer

Observations of wintering bald eagles are a bonus of the aerial waterfowl censuses conducted each fall and spring by Robert Crompton. Because the eagles feed primarily on fish, they concentrate along the Illinois and Mississippi rivers. The eagles are often difficult to see when perched in trees, but Crompton believes that he censuses approximately 75% of them.

In 1980, eagles began moving into Illinois from their northern breeding grounds during late October--1 to 2 weeks earlier than in 1976-78. Eagle numbers in the Illinois River valley between Spring Valley and Grafton reached a peak of 265 birds during the 1st week of January. This compares with peaks of 166, 240, and 361 birds for the winters of 1976-77, 1977-78, and 1978-79, respectively. The Seneca-Spring Valley segment hosted 15 additional eagles in 1980. Areas of eagle concentration in the Illinois Valley included Plum Island below Starved Rock Lock and Dam, Meyer's Ditch near Lake Chautauqua, Crane Lake, and the Six-mile Island area of Swan Lake.

In the Mississippi River valley, bald eagles increased gradually until late December 1980 when their numbers jumped to the following peaks: 328 birds from Moline to Alton during the 1st week of January, 113 birds from Dubuque to Moline in December, and 144 birds from St. Louis to Cairo in January. Major concentrations of the birds occurred below dams, particularly the Oquawka and Keokuk dams, where the water remained open for fishing during cold weather. Many birds were also observed in the Sny Slough and Grand Tower-Cape Girardeau areas. Unlike eagles in previous years, only a few individuals of the 1980-81 winter population dispersed to cooling lakes and reservoirs throughout the state. The November sighting of 6 birds at strip mine lakes in Fulton County is the only noteworthy observation.

Immature bald eagles 1 to 4 years of age can readily be identified by their mottled brown plumage, which contrasts greatly with the adult's conspicuous white head and tail. Approximately 40% of all eagles observed during the winter of 1980-81 were immatures as compared with 30% for the winters of 1976 through 1978. The actual percentage of immatures in the population is probably higher because the dull-colored immatures are more easily overlooked than adults when perched in shoreline trees.

Bald eagles began leaving for their breeding grounds in early March this year as evidenced by sudden increases in the numbers of birds observed in northern Illinois. The exodus was completed rather abruptly; by the last week of March, only a few stragglers were observed. Thus, the aerial waterfowl censuses provide a unique opportunity to monitor population changes of endangered bald eagles while they overwinter in Illinois.

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

August, 1981

Vol. 24, No. 8

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Cock call counts in May, 1981 on 5 study areas in east-central Illinois, compared with 1980, indicated that the number of cocks was nearly stable on Anchor and Harwood areas and declined moderately on Prairie Green, the Sibley Study Area (SSA), and Ford County Management Unit (FCMU) (Table 1). Spring visual roadside counts on the SSA indicated 6.7 cocks per 100 miles of driving, a decline from 16.5 cocks per 100 miles observed in 1980. On the FCMU, visual counts in 1981 indicated 18.3 cocks per 100 miles, a decline from 23.1 cocks per 100 miles in 1980.

Although indices of cock abundance declined in 1981 from the previous year, the density of breeding hens was estimated to be nearly identical for 1980 and 1981 when adjusted for winter sex ratio counts. Breeding populations on the study areas would probably have been greater in 1981 than in 1980 had there been no drought in central Illinois during the reproductive season of 1980.

Table 1. Cock calls per 2-minute stop for 5 study areas in east-central Illinois, 1976-81. Numbers represent averages of the 5 highest counts per stop per year. Department of Conservation personnel assisted with the audio censuses.

| Area | 1976 | 1977 | 1978 | 1979 ^a | 1980 | 1981 |
|---------------|------|------|------|-------------------|------|------------------|
| SSA | 12.8 | 2.8 | 2.0 | 2.8 | 3.7 | 1.9 ^b |
| FCMU | 22.9 | 7.8 | 6.4 | 6.1 | 10.1 | 7.2 |
| Anchor | 19.9 | 5.7 | 4.2 | 2.5 | 2.5 | 3.1 |
| Prairie Green | 28.4 | 9.2 | 3.0 | 8.0 | 9.2 | 8.0 |
| Harwood | 11.8 | 7.1 | 6.1 | 5.5 | 7.6 | 7.9 |

^aDue to unusually poor counting conditions, averages were computed for the 3 highest counts.

^bOnly 3 counts were made; conditions were less than optimal.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

Whereas hickory seed supplies some food for a variety of wildlife species, food habits studies have shown that, for Midwest squirrels, the hickory nut ranks as the 1st choice food in late summer and fall. At this time, squirrels are rapidly gaining weight, and hickory nuts, high in fat and very digestible, are important in improving the physical condition of squirrels before winter.

Seventy or so years ago, hickories were highly valued because the great strength of hickory wood was essential for the manufacture of wagon parts. Indeed, there was concern that quality hickory was being depleted through over-cutting in much of the eastern United States. With the advent of the automobile, the demand for and value of hickory wood declined to the point that, until recently, the hickories were considered weed species, to be culled from the forest at the earliest opportunity.

Wildlife managers who wish to increase the amount of seed-bearing hickory must consider the silvicultural requirements of the genus. Hickories are relatively tolerant of shade and seem to increase best under light cutting, wherein the canopy remains intact and the faster growing intolerants are unable to take over in the understory. Hickories are slow growers throughout life, compared with their hardwood associates, and are frequently relegated to an intermediate or suppressed crown position. The switch from light or selection cutting, where only small holes were made in the canopy, to complete clear-cutting has made it difficult to culture them, particularly on the better sites (site index 70+).

One cultural method, which might help overtopped hickory stems reach the canopy in clear-cuts, would be to crown-release suppressed hickories in clear-cuts <20 years old. To provide data on which to assess the merits of crown-releasing hickory, we selected seedling sprouts of pignut, shagbark, and mockernut hickories growing on good (site index for black oak 70+), medium (site index 55-70), and poor (site index 55-60) sites in stands clear-cut 6, 8, and 15 years before. Stems of each species were paired by height and stem diameter and 1 stem of each pair was selected for crown release by coin flip.

A comparison of height and stem-diameter growth between released and control stems after 5 growing seasons showed that stem-diameter growth was consistently better for released stems for all 3 species. Height growth was not consistently related to treatment. However, when growth rates for released and control stems were compared after 3 growing seasons and then for the combined 4th and 5th growing seasons, a different picture emerged. Released stems of mockernut grew slower in height compared with controls the first 3 years after release but faster than the controls the 4th and 5th years after release. A similar pattern was also observed for pignut on one site. Of some concern was the reduction in stem-diameter growth rate shown by virtually all stems the 4th and 5th years after release, reflecting an increase in crown competition as surrounding trees closed in around the released stems.

Considering all stems released on 3 areas, significantly more ($P < 0.01$) of the released stems were free-to-grow than the controls. When analyzed by species, only released mockernut had significantly more stems ($\chi^2 = 4.94$, $P < 0.05$) free-to-grow than the controls.

A single release cutting in clear-cuts <20 years old is unlikely to improve significantly the canopy position for shagbark and pignut hickories. For mockernut hickory, however, a single release cutting may be sufficient to enable suppressed stems to grow into the canopy. Stems selected for crown release should have an upright terminal with no obvious defects. We found that stems with deformed or damaged terminals rarely responded to crown release. With crown release, about 75% of the stems were free-to-grow. At this rate, a density of 10-12 codominant hickories averaging 12 inches dbh per acre could be achieved by releasing about 16 hickories per acre beginning before age 20 and continuing as necessary until growth of released stems is deemed satisfactory.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R.L. Westemeier,
J.E. Buhnerkempe

Our nest search this summer revealed 27 prairie chicken nests on 344 acres of sanctuary land in Jasper County and 10 nests on 117 acres of sanctuaries in Marion County. Percent nest success (excluding nests of unknown fate) was high in both counties: 70.8 (17 hatched nests) and 70.0 (7 hatched nests), respectively. This was the highest nest success for Jasper County since 1968, but the number of nests found was the 2nd lowest in 13 years. No comparison could be made in Marion County because this was the 1st year for extensive nest searches in the county.

The nest study also found 21 pheasant nests. In addition, pheasants had parasitized 5 of the 27 prairie chicken nests in Jasper County. This is the highest number of pheasant nests and cases of prairie chicken nest parasitism ever recorded on the area in a single year. Many pheasant nests were probably not found because the pheasant selects nest sites in a broader range of habitat than the prairie chicken, and because most of the nest search was concentrated on areas of high prairie chicken usage. There were probably more pheasant hens than chicken hens on the area (MWRL 24(6):2-3). Thus, for the 1st time in Jasper County, pheasant reproduction may have been greater than that of the prairie chicken.

Of the 21 pheasant nests found, 10 hatched, 8 were destroyed by predators, 2 were abandoned, and the eggs from 1 nest were collected and sent to a game farm where they hatched. Excluding the collected clutch, nest success for pheasants was 50.0%, compared with 42.7% nest success for 75 pheasant nests of known fates from 1969-80.

By using the number of hatched nests to predict the number of prairie chicken cocks the following spring in Jasper County (MWRL 23(12):3), an estimated 82.4 ± 15.0 cocks will be present on the booming grounds in the spring of 1982. However, with the increasing pheasant population, the spring cock count may deviate to the low side of our prediction for next spring.

Ecology and Management of White-tailed Deer - W-87-R

C.M. Nixon, L.P. Hansen,
J.E. Chelsvig, P.A. Brewer

Daytime cover is critical for deer survival in winter; it provides concealment, protection from harsh weather, and some food. A knowledge of the winter habitat requirements of deer is a useful management tool and, therefore, is a major focus of this project. Daytime in this study extends from the beginning of morning civil twilight (about 30 minutes before sunrise) to the end of evening civil twilight (about 30 minutes after sunset).

Visual and telemetric observations of radio-collared deer have provided some indication of habitat use (Table 2). The deer were typically found in mature or successional upland forested areas, which had a relatively dense understory of shrubs and small trees. Two deer also made extensive use of bottomland timber areas. All these habitat types seem to provide good protection from the gusty Central Illinois winds, which can cause a large loss of body heat. Nighttime habitat use is similar to daytime use except for the slightly increased use of crop fields while foraging.

Summer locations are being observed to see how much use deer make of abundant grain crops. This information will be presented in future reports.

Table 2. Winter habitat use by radio-monitored, adult, female, white-tailed deer expressed as a percentage of the total number of times the deer was located from 1 January to 31 March 1981.

| | Deer 316 | | Deer 336 | | Deer 338 | | Deer 248 | |
|---------------------------|----------|-------|----------|-------|----------|-------|----------|-------|
| | Day | Night | Day | Night | Day | Night | Day | Night |
| Mature upland | 55.9 | 44.4 | 48.6 | 31.9 | 42.7 | 18.6 | 36.4 | 23.3 |
| Successional upland | 33.9 | 14.3 | 37.8 | 34.0 | 28.6 | 4.7 | 9.1 | |
| Mature bottomland | 1.7 | 9.5 | 2.7 | 25.5 | 28.6 | 55.8 | 50.0 | 40.0 |
| Grass (mowed) | 3.4 | 6.3 | 2.7 | 2.1 | | 4.7 | 4.5 | |
| Wheat | 5.1 | 25.4 | 8.1 | 6.4 | | 9.3 | | 23.3 |
| Corn stubble | | | | | | 2.3 | | |
| Plowed | | | | | | 4.7 | | 13.3 |
| Total number observations | 59 | 63 | 37 | 47 | 35 | 48 | 22 | 30 |

Cooperative Waterfowl Research - W-88-R

F.C. Bellrose, S.P. Havera,
G.A. Perkins, H.K. Archer

Flocks of migrating waterfowl winging their way to northern breeding grounds are a welcome sign of the return of spring each year. Numbers of ducks in Illinois were already on the increase by late February 1981 when Robert Crompton made the 1st spring aerial census flight. Duck numbers in the Illinois Valley peaked at 206,600 in late February, 40% of the peak for the previous fall of 1980. In the Mississippi Valley, duck numbers peaked at 396,000 during late March, 42% of the fall 1980 peak. These numbers were considerably lower than the 1980 spring peak numbers for ducks: Illinois Valley, 1,642,500 (130% of fall 1979 peak) and Mississippi Valley, 1,160,000 (80% of fall 1979 peak).

Peak numbers of 36,000 Canada geese, approximately 600 of which were the giant race, and 2,600 snow geese were present in the Illinois Valley during February of 1981. The Mississippi Valley hosted peak numbers of 5,300 Canada geese and 2,900 snow geese. These peaks for the entire spring migration represented only 5-20% of the geese observed in the same locations during the 1980 spring.

Waterfowl stay in Illinois for a shorter time during spring migration than during fall migration. Goose concentrations decreased abruptly by mid-March of 1981, and duck numbers were declining rapidly by the 1st of April. Common golden-eyes and common mergansers, which overwinter in Illinois, are the 1st species to depart for the northern breeding grounds. Geese are also early migrants, followed by such dabblers as pintails, mallards, black ducks, and wigeon, some of which spend the milder winters in Illinois. The majority of the diving ducks arrive about midway during the migration season; canvasbacks and redheads are the 1st to appear and scaup and ruddy ducks are the last to leave. The latest spring migrants are blue- and green-winged teal and northern shovelers.

Many factors cause the timing and duration of the spring migration to vary from year to year: the inconsistency of spring weather (probably the most important factor), water levels and food conditions (which are partially dependent upon weather), and the physiological readiness of the birds to migrate.

The unusually mild winter and spring in Illinois in 1980-81 may have allowed some waterfowl to winter farther north than normal, thus partially explaining the smaller numbers of birds observed in Illinois during spring migration. Scarcity of food probably also encouraged migrants to move quickly through Illinois rather than concentrate on the rivers and lakes where they could be censused.

Because fall waterfowl populations are dependent upon the number of breeders and breeding ground conditions, the low number of spring migrants is a concern. May aerial censuses of the breeding grounds by the U.S. Fish and Wildlife Service revealed a decline in breeding numbers of most waterfowl species. Breeding numbers of the mallard, the number 1 species of waterfowl harvested in Illinois and the Mississippi Flyway, were the lowest censused by the U.S. Fish and Wildlife Service since 1962. Because of drought conditions on the breeding grounds and lower numbers of breeding ducks, we expect to census fewer numbers of waterfowl in Illinois this fall.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

September, 1981

Vol. 24, No. 9

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

In 1981 a record 93% of the Sibley Study Area (SSA) was planted in corn and soybeans. In addition, 0.9% of the land (172 acres) was planted in tame hay, according to maps of crop types and field boundaries. From 1977 through 1980, tame hay comprised 1.2, 1.6, 1.2, and 0.8% of the SSA, respectively. Small grains were planted on 1.2% of the SSA in 1981, compared with 1.4, 0.9, 0.9, and 1.3% from 1977 through 1980.

This year, for the 9th and probably the last consecutive summer, pheasant nest studies were conducted on the Ford County Management Unit (FCMU). Densities of hatched nests averaged 0.15 per acre on seeded roadsides in 1981, compared with 1.30, 1.23, 0.27, 0.48, 0.17, 0.12, 0.09, and 0.09 per acre in 1973 through 1980, respectively. The estimated total of pheasant nests hatched per section on the FCMU was 2.7 for 1981, compared with 26.3, 16.5, 8.0, 8.0, 2.2, 1.3, 1.1, and 2.2 for 1973 through 1980, respectively.

Next month we will consider fall recruitment into the pheasant population on study areas in east-central Illinois.

Ecology and Management of Squirrels - W-66-RC. M. Nixon,
L. P. Hansen

One of several approaches to culturing seed-bearing hickories after clear-cutting is to reserve long-suppressed hickory poles (3" - 8" dbh) in new clear-cuts. To determine the survival and growth rates of long-suppressed trees, we marked 74 hickory poles (43 shagbarks, 31 pignuts) in 3 new clear-cuts. After 5 growing seasons, 8 (18.6%) of the shagbarks had died and 16 (37.2%) were not growing due to broken tops or failure to develop a terminal bud. Of the marked pignuts, only 4 (12.9%) had died after 5 growing seasons, but 11 more (35.5%) were stagnated and unlikely to survive. Thus about 50% of the marked trees of both species failed to survive for 5 years.

We found that trees growing <50 m from uncut forest survived significantly better ($P < 0.05$) than trees further away. Trees on poor sites (upper west or southwest slopes and ridgetops) had significantly higher mortality ($P < 0.01$) than trees on the better sites.

There was considerable epicormic branching on the marked hickories of both species 5 years after clear-cutting. Epicormic branching was significantly more prevalent ($P < 0.05$) on trees growing on good sites and on trees with less than a full crown when released. The amount of epicormic branching per tree was not significantly affected ($P > 0.05$) by the species of hickory or the distance from the uncut forest.

The presence of grapevines in the crown was not significantly related to mortality in either species. For live trees after 5 growing seasons, grapevines were present in 9 (29%) and 7 (26%) of the shagbarks and pignuts, respectively. Six of the 9 shagbarks and 4 of 7 pignuts were growing well and apparently unaffected by the presence of the grapevine. Grapevines were most prevalent on medium or better sites, areas where they can seriously obstruct tree growth following clear-cutting.

Leaving suppressed hickory poles standing after complete clear-cutting increases the likelihood of trees reaching seed-bearing age in a dominant or codominant crown position. Select trees with at least one-half a full crown and without excessive lean or obvious disease or injury. Trees <50 m from the uncut forest will survive best. Selection of trees with these characteristics should reduce the high mortality rate (nearly 50%) found in our study and also reduce the amount of epicormic branching on each tree bole. Foresters will be more apt to retain these hickories during thinning operations if epicormic branching, which causes a considerable reduction in log grade, covers <25% of the tree bole.

The goal should be to produce 30-35 seed-producing hickories per ha (12-15 per acre) at stand age 30 and retain them until rotation age for the site. Intermediate thinnings during the life of the stand will allow a new crop of suppressed hickory poles to develop in the understory, some of which could be retained when the stand is again clear-cut.

Responses of Prairie Chickens to Habitat Manipulation-W-66-R

R.L. Westemeier,
J.E. Buhnerkempe

A total of 522 nests for 11 avian species was found during the search of 348 acres on the prairie chicken sanctuaries in Jasper County this summer. The density of 15.0 nests per 10 acres was an increase of 6.9 nests per 10 acres over 1980. The most notable increase was in meadowlark nest density; it jumped from 0.3 nest per 10 acres in 1980 to 1.7, the highest density since 1972. The pheasant nest density was at an all-time high of 0.5 nest per 10 acres, and the bobwhite quail nest density showed the first increase in 6 years from 0.1 nest per acre in 1980 to 0.3 this year. Other species showing increases were the red-winged blackbird (6.2 nests per 10 acres in 1980 to 10.4 this year) and the dickcissel (0.5 nest per 10 acres in 1980 to 0.8 this year). Birds for which nests were found this year but not in 1980 were the mourning dove (0.2 nest per 10 acres), field sparrow (0.2 nest per 10 acres), grasshopper sparrow (0.1 nest per 10 acres), and mallard (0.1 nest per 10 acres).

The relative abundance of the nesting fauna at Bogota has been discussed as a factor affecting prairie chicken nest success (MWRL 20(12):3, 22(7):2-4, and 23(2):3-4). Increases in the population level of the other grassland species on

the area were found to buffer predation on prairie chicken nests. Thus, the increase in the number of buffer species in 1981 may be a major factor for the high nest success of 70.8% for prairie chickens this year. Predation on prairie chicken nests is probably reduced by an abundance of alternative food choices.

Ecology and Management of White-tailed Deer - W-87-R

C.M. Nixon, L.P. Hansen,
J.E. Chelsvig, P.A. Brewer

Spring is an interesting time to observe deer. During that season, many deer disperse from winter concentration areas. Many radio-monitored deer dispersed from the Allerton Park study area during spring 1981, some accompanied by their 1980 fawns (Table 1).

All deer but one confined their movements to the Sangamon River drainage. Most moved between mid-April and early May. Forest vegetation had blossomed and was actively growing by mid-April and provided adequate food and cover for traveling deer. Three deer (an adult female and her fawns) left the Park early on 24 January, less than 2 weeks after capture. This early movement may have been due to disturbance by the researchers. Earlier, these deer may have been pushed onto the Park from their original winter range by hunting pressure or some other disturbance.

Only one deer (305-06) moved out of the Sangamon River drainage. Due to transmitter failure, we do not know the location of her summer range or the exact time and end point of her movement. Fortunately, she was sighted 16 June on the south edge of Champaign, Champaign County--43.2 km (27 mi) E-NE from where she was last seen in Allerton Park. Most corn was less than 30 cm (approximately 1 ft.) tall and would not provide adequate cover for deer. We cannot explain this direction of travel, but it is similar to the movement in spring 1980 by another deer of the same age and sex.

With the approach of another fall hunting season, we expect to learn more about dispersal movements of deer.

Table 1. Distances and directions of dispersal movements from Allerton Park for white-tailed deer marked in 1981.

| Number | Age ^a | Sex | Mi. | Km. | Direction | Date last seen in park area | First date found in new location |
|---------------------|------------------|-----|------|------|-----------|-----------------------------|----------------------------------|
| 303-04 | A | M | 2.6 | 4.2 | NE | 4/13/81 | 4/23/81 |
| 305-06 ^b | SA | F | 27.0 | 43.2 | E-NE | 6/03/81 | 6/16/81 |
| 307-08 | A | F | 6.5 | 10.4 | NE | 1/24/81 | 1/26/81 |
| 309-10 | SA | M | 11.0 | 17.6 | SW | 4/12/81 | 5/12/81 |
| 311-12 | SA | M | 6.5 | 10.4 | NE | 1/24/81 | 1/26/81 |
| 314-15 | SA | M | 6.5 | 10.4 | NE | 1/24/81 | 1/26/81 |

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|---------------------|----|---|------|------|----|---------|---------|
| 329-30 | SA | F | 17.5 | 28.0 | SW | 4/15/81 | 5/12/81 |
| 334-35 ^c | SA | M | 8.5 | 13.6 | SW | 4/28/81 | 5/01/81 |
| 338-39 | A | F | 8.3 | 13.3 | N | 4/24/81 | 5/01/81 |
| 245-46 | SA | F | 7.0 | 11.2 | NE | 5/03/81 | 5/06/81 |
| 247-48 | A | F | 7.0 | 11.2 | NE | 5/03/81 | 5/06/81 |

^aAge: A = >1 year; SA = <1 year

^bLast seen on the S edge of Champaign, Champaign Co., Ill., 16 June 1981.

^cReturned to Allerton Park 6 May 1981 but remained on the opposite side of the Park from his winter range.

Cooperative Waterfowl Research - W-03-R

F.C. Bellrose, S.P. Havera,
G.A. Perkins, H.K. Archer

Aerial waterfowl censuses conducted by Robert Crompton provide valuable information about waterfowl species that are abundant as migrants in Illinois. These censuses also provide an opportunity to monitor uncommon waterfowl species and other avian species associated with the rivers and the adjacent bottomland lakes. Among the uncommon waterfowl species occasionally observed during the aerial censuses are the mute and whistling swans. The exotic mute swan was introduced and became locally established in North America. Mute swans have been observed numerous times in the Illinois Valley during the falls of 1977 through 1979 and were observed once in the Mississippi Valley during the fall of 1977. The largest total number of mute swans counted in the Illinois Valley for an entire fall was 209 in 1973; the peak number counted on a single flight was 36 on 26 September 1976.

Whistling swans are rarely seen in Illinois; only 6 were sighted from 1976 through 1979. However, a total of 94 were counted in the Mississippi Valley during late March, early April, and late October of 1980. The largest number of whistling swans seen on a single flight in recent years was 48 on 17 April 1980.

Double-crested cormorants and white pelicans are also counted during aerial censuses. The cormorant is on Illinois' endangered species list but often is seen in the Illinois and Mississippi valleys during fall and spring migrations. Until the mid-1950's, the double-crested cormorant was a common migrant and a fairly common nester in the Illinois River valley. An estimated 15,000 migrants were counted in the Illinois Valley on 16 October 1950. By 1958, the great passages of cormorants had dwindled to a small flight of 300 individuals. No birds were counted between 1966 and 1973. Their numbers have been on the increase

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since 1976 with a total count of 2,106 birds in the Mississippi Valley and 2,524 birds in the Illinois Valley during 1980. Although cormorants are more frequently observed in the fall (between mid-September and mid-November) than in the spring, the peak numbers for a single flight in recent years occurred during late March with 533 birds counted in the Illinois Valley in 1979 and 523 birds in the Mississippi Valley in 1980. These observations indicate that the populations of the once-abundant cormorant may be recovering slightly.

White pelicans are observed during aerial censuses in September and October. The total numbers of birds counted have varied greatly each fall since 1976, but the Mississippi Valley consistently hosts the majority of the migrants. Peak numbers of pelicans sighted on a single flight since 1976 were 103 in the Mississippi Valley and 16 in the Illinois Valley on 27 September 1977.

Aerial census observations help provide information on the migration and distribution of occasional migrants in Illinois, such as whistling swans and pelicans. Observations of the endangered double-crested cormorant may provide a useful index to their population dynamics. Thus, aerial censuses supply a valuable data base for common and uncommon avian visitors to the Illinois and Mississippi river valleys.

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MONTHLY WILDLIFE RESEARCH LETTER

NATURAL HISTORY SURVEY

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Illinois Federal Aid Projects W-66-R, W-37-R, and W-88-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

October, 1981

Vol. 24, No. 10

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Recruitment of juveniles into the fall population of pheasants on 5 study areas in east-central Illinois has improved little since 1979 (Table 1). An improved rate of recruitment would indicate pheasant populations are recovering from the decimating winter storms of 1977-78.

On the Ford County Management Unit (FCMU), spring breeding censuses (MWRL 24(8):1) and nest data (MWRL 24(9):1) indicate pheasants made some recovery in 1980 and 1981. However, the improved rate of hatched nests has not resulted in substantial increases in fall pheasant densities. An unusually high proportion of early nests hatched on the FCMU in 1981, presumably due to fair spring weather. These early hatches in hay and on some roadsides accounted for most of the increase in successful nests on the FCMU in 1981 over 1980 (MWRL 24(9):1).

Brood censuses (Table 1) on the 5 study areas in 1981 detected almost no broods that hatched after mid-June. On the Sibley Study Area (SSA), the 10 brood counts in July were the highest in several years, but in August, the number of broods declined steadily through the 11 counts taken. This decline is attributed to mortality, to the reduced chances of older broods being observed during roadside censuses, and to a lack of chicks hatched later than June. In east-central Illinois, frequent torrential rains during July and August may have impaired the survival of embryos and young pheasant chicks.

Next month, we will consider the November 1981 hunter harvest of pheasants on the study areas.

Table 1. Broods observed per 100 miles of driving in August on 5 study areas in east-central Illinois. Illinois Department of Conservation personnel (project W-85-D) assisted with the censuses.

| Year | SSA | FCMU | Anchor | Harwood | Prairie Green |
|------|------|-------|--------|---------|---------------|
| 1977 | 2.31 | 26.92 | 5.16 | 7.00 | 5.73 |
| 1978 | 0.97 | 0.63 | 1.96 | 4.27 | 2.52 |
| 1979 | 2.90 | 4.38 | 0.74 | 7.50 | 3.90 |
| 1980 | 2.25 | 4.33 | 5.71 | 5.00 | 4.59 |
| 1981 | 1.63 | 3.75 | 4.00 | 5.63 | 3.77 |

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

To understand why and to what extent life history characteristics such as reproduction and survival fluctuate is to understand why squirrel numbers fluctuate and why knowledge of these demographic parameters is essential to sound management. As part of a 7-year study of an unexploited squirrel population at the Vermilion River Observatory (VRO) near Danville, we live-trapped and marked squirrels at 6-month intervals. This permitted life-table analyses and evaluation of seasonal and annual variability of both recovery and reproductive rates.

The life-table analysis indicated that mean annual mortality rates for male (34%) and female (37%) fox squirrels at the VRO was low compared to mortality rates reported in the literature, especially those of exploited populations. For fox squirrels less than 1.0 year old, males survived better than females, although the differences were not significant. Male and female fox squirrels 1.0 year and older had similar survival rates. A comparison of age classes with sexes lumped indicated that survival of fox squirrels 0.2 year old at first capture was significantly poorer ($P < 0.01$) than survival of squirrels 0.5 year old at first capture; survival of both these age groups was poorer ($P < 0.01$) than that of squirrels older than 0.5 year at first capture. Yearling and adult survival did not differ significantly.

Six-month recovery rates also indicated that survival of young at the VRO was poorer and more variable than that of yearlings and adults. At least part of the loss of young was due to dispersal off the study area. Fox squirrels apparently become "established" some time between 0.5 and 1.0 year, after which little dispersal occurs and survival is high. Some adults apparently did disperse, as indicated by the capture of untagged adults during some trapping periods. Survival of these adult dispersers was significantly poorer ($P < 0.01$) than that of adults that had been tagged as young and remained on the area. Apparently these dispersing adults had not established residency but were wandering in search of suitable unoccupied habitat.

In next month's newsletter we will evaluate the factors that most strongly influence survival rates.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R

R.L. Westemeier,
J.E. Buhnerkempe

The number of unsuccessful prairie chicken nests parasitized by pheasants has increased with the increase in pheasant abundance at Bogota (Table 2). The desertion of unparasitized prairie chicken nests has also increased and may be related to pheasant abundance. Chickens deserted their nests at similarly high rates in both 1969-73 and 1981, but pheasant numbers were not similar: 4-3 cocks in 1969-73 and 48 cocks in 1981. Some nest desertion in 1969-73 may have been due to intra-specific behavior generated by high population density of chickens; nest desertion in 1981 may have been due to interspecific pressure from pheasants.

The desertion rate for prairie chicken nests in Marion County and other areas of Illinois (3.0%) with few or no pheasants was similar to that at Bogota for 1963-68 (3.2%) when pheasants were absent or rare. This further implicates the pheasant as a factor in reduced productivity of prairie chickens at Bogota.

Trends in mean numbers of hatched eggs per nest and the percentage hatchability of prairie chicken eggs also appear related to pheasant abundance (Table 3). In both Jasper and Marion counties, when few or no pheasants were present, the mean number of hatched chicken eggs per nest was about 11 and hatchability exceeded 92%. These data are essentially identical with nest data collected by Dr. Ralph E. Yeatter in the 1930's (pheasants essentially absent) in Jasper County. At Bogota, the data for prairie chickens show a decline from 11.1 to 9.5 hatched eggs per clutch and from 93.3 to 82.6% hatchability from the 1963-68 period to 1981.

Fertility ($\bar{X}$ = 94.4%, range 91.0-97.2%) has been relatively stable over the same 19-year period. Thus, embryonic mortality, not infertility, has caused the decline in egg hatchability.

A comparison of current data from Bogota with data from Jasper County in the pre-pheasant years and from Marion County suggests that nesting hens have altered their behavior, such as reduce attentiveness during incubation, because of harassment by pheasants. Thus, pheasants may also be a principal factor in the increased embryonic mortality noted at Bogota.

Table 2. Comparison of unsuccessful prairie chicken nests parasitized by pheasants and desertion of prairie chicken nests with population levels of pheasants in Jasper and Marion counties.

| Year(s) | Est. number
of pheasant
cocks in area | Sample
size | Prairie chicken nests | |
|-------------------------------|---|----------------|-------------------------------|---------------------------------|
| | | | % Unsuccessful
parasitized | % Deserted
(not parasitized) |
| JASPER COUNTY | | | | |
| 1963-68 | 0-1 | 62 | 0.0 | 3.2 |
| 1969-73 | 4-8 | 307 | 1.6 | 7.5 |
| 1974-80 | 14-26 | 299 | 2.7 | 4.7 |
| 1981 | 43 | 25 | 8.0 | 8.0 |
| MARION COUNTY AND OTHER AREAS | | | | |
| 1964-81 | 0-1 | 33 | 0.0 | 3.0 |

Table 3. Comparison of hatchability of prairie chicken eggs with population levels of pheasants in Jasper and Marion counties.

| Year(s) | Est. number
of pheasant
cocks in area | Prairie chicken nests ^a | | |
|---------------|---|------------------------------------|--------------------------------|-------------------------|
| | | Number
of clutches | Mean number of
hatched eggs | Percent
hatchability |
| JASPER COUNTY | | | | |
| 1963-68 | 0-1 | 37 | 11.1 | 93.8 |
| 1969-73 | 4-8 | 114 | 10.7 | 89.6 |
| 1974-80 | 14-26 | 72 | 9.6 | 85.4 |
| 1981 | 48 | 6 | 9.5 | 82.6 |
| MARION COUNTY | | | | |
| 1964-80 | 0-1 | 5 | 11.4 | 100.0 |
| 1981 | 1 | 4 | 10.8 | 91.9 |

^aIncluding only incubated clutches for which the count of eggs was judged to be complete.

Ecology and Management of White-tailed Deer - W-87-R

C.H. Nixon, L.P. Hansen,
J.E. Chelsvig, P.A. Brewer

Spotlight censuses have been started at Allerton Park to estimate the fall deer population and to monitor population changes caused by the fall hunting season and by animals moving into or out of the Park. Censuses are conducted at 2-week intervals from just before sunset through the first 2 hours of darkness. Two vehicles are used for a census, each following a standardized route.

To date, only 2 censuses have been run. Visibility was limited by understory vegetation still present in the forest. Only adult and yearling females were counted because they are seen more frequently than the secretive adult males, and they are easier to identify. The number of adult and yearling females in the Park was estimated from the number of marked deer seen relative to the number of marked deer known to be in the Park and the number of unmarked deer seen.

The first censuses each indicated that there are 48 adult and yearling females in Allerton Park, the adjoining 4-H Memorial Camp, and private land bordering the Park. Assuming 1.6 fawns per doe (from a 1975 Iowa study) and an approximate 50:50 ratio of bucks to does, the estimated number of deer is 124.

Because this figure is considerably higher than the winter aerial census (MWRL 24(4):3), its accuracy may be questionable. Errors may have been made in estimating the number of marked deer or by double counting some animals, though every effort was made to count each deer only once.

This population estimate is somewhat crude and more censuses are needed. We will record all known mortalities in and around the Park and will compare aerial counts made this winter with future spotlight censuses.

Cooperative Waterfowl Research - W-88-R

F.C. Bellrose, S.P. Havera,
G.A. Perkins, H.K. Archer

The first sign in Illinois of the fall waterfowl migration is the arrival of small flocks of blue-winged teal, usually in late July. Bluewings leave their breeding grounds in south-central Canada and north-central U.S. and stop briefly in Illinois for food and rest. In the first aerial census this fall (conducted 8 September by Robert Crompton), bluewings numbered 20,500 in the Illinois River valley and 10,000 in the Mississippi River valley. However, teal numbers declined in the 2 subsequent weekly censuses. In 1978 through 1980, bluewing numbers peaked in the first or second week of September; average peaks were 42,600 and 16,300 birds in the Illinois and Mississippi valleys, respectively. High water in the Illinois Valley throughout summer 1981 inundated mudflats and prohibited the growth of moist-soil plants which produce seeds for blue-winged teal to feed upon. The lack of mudflats and associated food along the Illinois River is probably the primary reason for the large decrease in teal numbers observed during the recent aerial censuses. Many birds undoubtedly found food in flooded agricultural fields of the bottomlands where they were not censused.

The fall migration of green-winged teal through Illinois is later and more protracted than that of blue-winged teal. In 1978-80, greenwing numbers peaked in October or early November; peak numbers averaged 17,600 birds in the Illinois Valley and 13,300 birds in the Mississippi Valley. On 14 September 1981, green-wing numbers totaled 6,300 in the Illinois River valley and 5,300 in the Mississippi River valley; 1978-80 averages for a similar date were 9,600 and 4,100 for the Illinois and Mississippi River valleys, respectively.

Both species of teal have preferred certain bottomland lakes and water areas in recent years. In the Illinois Valley, teal concentrate at Goose Pond (near Hennepin) and Rice Pond, as well as Pekin, Rice, Spring, Chautauqua, Anderson, Jack, Crane, Meredosia, Flat, and Swan lakes. In the Mississippi Valley, teal concentrate largely in the Dallas City to Fort Madison segment of the river and the Louisa and Batchtown refuges.

High water during summer 1981 may have been favorable for some avian species, such as egrets. An unusually large number of 6,000 egrets was observed in the Illinois Valley. On 14 September, 3,600 egrets were seen in the Mississippi Valley. The abundance of egrets, however, does little to console waterfowl hunters for one of Illinois' poorest teal-hunting seasons.

MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

November, 1981

Vol. 24, No. 11

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Last month (MWRL 24(10):1), we postulated that mortality was unusually high in 1981 for pheasant chicks that hatched after the normal mid-June peak on the Ford County Management Unit (FCMU) and Sibley Study Area (SSA). However, molt data from juvenile cocks bagged on the study areas during opening weekend (7-8 November 1981) did not substantiate that hypothesis. Primary feather lengths of 16 juvenile cocks inspected opening weekend, 1981, indicated that 8 (50%) hatched during the last week of June or later; 43% and 39% of juvenile cocks hatched during the same period in 1980 and 1979, respectively.

Greater effort was needed to bag a cock on the SSA and FCMU in 1981 than in 1980 (Table 1). The increased time per cock bagged is attributed to the slow progress in fall farm operations. Pheasants were able to seek refuge from hunters in unharvested corn and in vast acreages of unplowed corn stubble. The few hunters (Table 1) were unable to keep the birds moving and vulnerable to the gun. If harvest and tilling operations had been as nearly complete by opening weekend in 1981 as in 1980, hunter success would probably have been as high this year as for any opening weekend since 1975 (Table 1).

Table 1. Pheasant hunting statistics on the Sibley Study Area (SSA) and Ford County Management Unit (FCMU) during the opening weekend of the upland game season, 1973-81.

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|------|------|------|------|------|------|------|------|------|
| Parties interviewed ^a | 28 | 36 | 28 | 27 | 18 | 30 | 26 | 21 | 19 |
| Parties sighting cock pheasants ^a | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. | 22 | 20 | 16 |
| Cock pheasants bagged ^a | 91 | 73 | 78 | 80 | 27 | 56 | 26 | 48 | 31 |
| Percentage of birds aged juvenile ^a | 85 | 71 | 62 | 74 | 75 | 84 | 81 | 76 | 79 |
| Man-hours expended per cock bagged | | | | | | | | | |
| SSA | 7.4 | 8.3 | 16.5 | 9.7 | 35.0 | 18.4 | 71.0 | 9.9 | 48.0 |
| FCMU | 7.4 | 3.1 | 4.7 | 6.2 | 11.6 | 7.9 | 11.1 | 5.3 | 9.7 |
| Man-hours expended per pheasant observed ^a | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. | 2.0 | 1.1 | 1.8 |

^a-Statistics for both study areas combined.

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Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

Recovery rates for ear-tagged fox squirrels, especially for young squirrels, varied considerably among seasons at the Vermilion River Observatory near Danville (NWRL 24(10):2). Fox squirrels feed extensively on tree seeds, especially those of oaks and hickories, and the production of these seeds may vary tremendously from year to year. Several researchers have suggested that this variability in mast production may influence survival rates of squirrels, particularly during the fall. Correlations between the recovery rates of the different age classes of squirrels and white oak, black oak, hickory, and total mast production revealed only 2 significant relationships ($P < 0.05$). Survival of yearlings was positively related to hickory production and negatively related to white oak production. The lack of other significant relationships and the inconsistencies in the significant values (positive and negative) suggest that chance and not biological significance may have caused the significant results. In fact, 2 significant relationships at the 5% level might be expected by chance alone given the large number of correlations performed.

The failure to demonstrate any consistent relationship between mast abundance and survival may have been due in part to a lack of sufficient sample sizes but was probably due to the absence of a complete mast failure during the 7-year study. At least 1 species of oak or hickory always produced seed. Fox squirrels are opportunistic feeders; when preferred foods fail, they eat the most available food, including agricultural crops. Apparently, there were no extreme food shortages during the period of the study, and therefore recovery rates were not affected by mast production. In next month's newsletter we will look at other factors which might affect survival in fox squirrels.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R

R.L. Westemeier,
J.E. Buhnerkempe

Nest success for prairie chickens on the Bogota Study Area was above average in 1981. Seventeen (68%) of the 25 prairie chicken nests of known fate hatched. By contrast, for 1963-80 at Bogota, nest success averaged 49% for 662 nests of known fate, though these differences were only significant at the 0.90 level.

However, there are alarming trends, such as increases in (1) parasitism of prairie chicken nests by pheasants, (2) unsuccessful parasitized nests, (3) deserted nests, and (4) embryonic mortality (NWRL 24(10):2-4). All of these adverse trends appear related to abundance of pheasants at Bogota.

Also, there is mounting evidence that both breeding efforts (NWRL 24(7):2-3) and nesting efforts by prairie chickens at Bogota are becoming increasingly concentrated. Since 1970, the central sanctuaries (Yeatter-Field-McGraw and Donnelley) at Bogota have shown an increase in the percentage of total prairie chicken nests found during annual nest searches. The central units accounted

2. The second part of the document describes the various methods used to collect and analyze data. It includes a detailed discussion of the different types of data that can be collected, such as financial data, operational data, and customer data. It also discusses the various techniques used to analyze this data, including statistical analysis, data mining, and machine learning.

for 100% of the chicken nests found in both 1980 and 1981, although substantial acreages were searched on the peripheral units (32% of 418 acres and 15% of 397 acres, respectively). This concentration of both nesting and booming ground activities by chickens may reflect Gause's principle of competitive exclusion. In our situation, the principle involves the restriction of prairie chickens to a reduced range (Yeatter-Field-McGraw and Donnelley sanctuaries) where they can apparently sustain some advantage over competing ring-necked pheasants. If only intraspecific competition among prairie chickens were involved at Bogota, the booming cocks and nesting hens should show a greater tendency to sustain occupancy of the peripheral sanctuaries largely or wholly abandoned since pheasants became common at Bogota.

Ecology and Management of White-tailed Deer - W-87-R

C.H. Nixon, L.P. Hansen,
J.E. Chelsvig, P.A. Brewer

Only 1 adult male was captured in Allerton Park during winter trapping in 1980-81. This yearling buck was fitted with a radio-transmitter collar and monitored throughout the winter. One-hundred-twenty-one locations were recorded for this individual--a daytime location nearly every day and a nighttime location on 3-4 consecutive nights every 2 weeks. The winter range of this deer, determined by the minimum area method, was 138 hectares (341 acres), considerably larger than the mean range measured for does and fawns ($\bar{x} = 94.9$ ha, range = 71-117 ha).

On 10 April, this radio-monitored buck shifted his range 2.6 km (4.2 mi) up river from his winter range. On this summer range, it was nearly impossible to locate him precisely because of the increased distance from the study area, a weak transmitter signal, and dense vegetation. We estimated his locations and he appeared to be relatively sedentary until 10 September 1981, when he was found on his former winter range. From that time on, his movements were more extensive. For example, on 16 November between 1700 and 2200 hours, he moved approximately 6.4 km (4.0 mi) up river past Monticello. By the next morning, he was back down river near where he had started the previous night. These longer movements are believed to be related to the breeding season. We will continue to monitor this buck through the hunting season and for as long as the equipment continues to function and the deer survives.

Cooperative Waterfowl Research - W-88-R

F.C. Bellrose, S.P. Hayera,
G.A. Perkins, H.K. Archer

Spring and summer of 1981 were quite unusual in the Illinois River valley. Record rainfall in the drainage basin maintained river levels at or above flood stage on the Havana gauge from the third week of April through the end of August. The river level peaked at 1.7 m (5.5 ft) above flood stage during the last week of May. This prolonged high water adversely affected some of the plant communities and avian migrants of the river valley.

The most drastic effect of the high water was on moist-soil plants. For these plants to germinate and produce seeds, water levels must be low enough by mid-July to expose mudflats along the shores of the bottomland lakes. No mudflats were exposed this past summer. Consequently, there is little food in the bottomland lakes for those dabbling ducks, such as blue- and green-winged teal, pintails, and to a lesser extent, mallards, which feed on the seeds of moist-soil plants. Because of the high water, the managed lands of most duck clubs and public areas along the Illinois River could not be planted with cultivated crops such as Japanese millet and corn. Therefore, waste grain in farm fields constitutes the major food for dabbling ducks this fall in the Illinois River valley. Food availability is a major factor determining abundance, distribution, and duration of stay of waterfowl in the Illinois Valley. This fall, ducks will concentrate in areas with the best food resources and individuals may stay less than the 3 weeks they usually spend in a given area.

Without exposed mudflats, wading shorebirds had few feeding areas in August and September during their fall migration. The Illinois Valley is a traditional and essential stopover area where shorebirds rest and replenish their energy for the remainder of their flight to the wintering grounds in the southern U.S. and South America.

Certain species of trees and shrubs in the bottomlands were stressed by the prolonged flooding during the growing season. A variety of plants lost leaves that were inundated and some plants never flowered. Some species, such as silver maples and willows that had their root crowns inundated since late April, turned color prematurely in early August. Seedlings and saplings of all tree species appeared to be less tolerant of the high water than mature trees.

The worst effect of this year's record precipitation and high water was severe sedimentation in the bottomland areas. Increased runoff from cultivated lands into the tributaries and eventually into the river and its backwaters aggravated sedimentation and turbidity in the Illinois River valley. In some backwater areas, several inches of new sediment were exposed when water levels receded in September.

the subject of the present paper is the question of the
existence of a certain type of solution of the
equations of motion of a system of particles
interacting with each other and with an external
field. The question is whether there exists a
solution of the equations of motion which is
periodic in time. The answer to this question
is affirmative. The existence of such a solution
is proved by the method of the variation of
constants. The method consists in assuming
that the solution has the form of a series
in powers of a small parameter. The
coefficients of this series are determined
by the method of the variation of constants.
The method is applied to the case of a
system of two particles interacting with each
other and with an external field. The
result is that there exists a periodic solution
of the equations of motion.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R, W-67-R, and W-68-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Urbana, Illinois

December, 1981

Vol. 24, No. 12

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

The number of pheasant chicks that survive from hatch to early autumn apparently has declined in the last few decades according to recent censuses. On the Sibley Study Area (SSA), the mean number of chicks observed per brood was 6-7 during 1956-59, 5-6 during 1960-64, approximately 4 during 1965-69, and 3-4 chicks during the 1970's. These data--particularly the declines through the late 1950's and early 1960's--are corroborated by counts made in the central counties by the Department of Conservation.

Survival studies on the SSA have indicated that mortality of juveniles has traditionally been extensive during the fall. For example, during 1962-66 an average of 44% of the juvenile hens survived from October to February. The more recent decline in the survival of chicks during summer may be coupled with relatively low rates of survival during fall. If fall survival data from the SSA during the 1960's are valid for current populations, only 1 of 4 female chicks hatched per nest may survive to winter. This hypothesis may explain in part the slowness of pheasants in east-central Illinois to recoup numbers lost in recent severe winters (MWRL 24(10):1).

It is difficult to make an in-depth study of chick survival. The low numbers of pheasants on the study area prohibit investigative procedures that require large samples to test hypotheses. However, the potential causes of decreased chick survival have been explored by monitoring brood size, and by small-scale studies of the use of cover by broods, pesticide metabolism, nutrition, and predation. These studies will be reported in future newsletters.

Ecology and Management of Squirrels - W-66-RC. M. Nixon,
L. P. Hansen

We concluded last month (MWRL 24(11):2) that mast abundance did not cause the variability in recapture rates of fox squirrels during the 7-year study at the Vermilion River Observatory. Social factors have been implicated by numerous researchers in the regulation of rodent population size. Apparently, aggressive behavior by adult residents, especially during the breeding season, reduces survival in an area of subordinate, usually young, animals. Although few data are available, it is generally thought that these young disperse.

Correlations between adult population size and recapture rates of different age classes may be an indication of social regulation. If social factors are important in density regulation, we would expect a negative relationship between survival and densities. Recapture rates of resident (≤ 0.5 years old when first captured) adult male and female fox squirrels were not significantly ($P > 0.05$) related to the number of squirrels present. Immigrant (> 0.5 years old when first captured) adult survival, however, was negatively related ($P < 0.05$) to the number of adults, most strongly to the number of females. Juvenile survival, surprisingly, was positively correlated ($P < 0.05$) with the number of resident adults--total males and total females. Subadult and yearling female recapture rates were negatively related to the number of males and the number of resident females ($P < 0.05$). Densities and recapture rates of subadult males were not significantly related; whereas recapture rates of yearling males was negatively related to the number of adult females and positively related to the number of resident males ($P < 0.05$). Survival from birth to 0.5 year was negatively related to the number of resident females and positively related to the number of adult males ($P < 0.05$).

We would expect several significant relationships by chance alone given the large number of correlations performed. Our problem is selecting the biologically meaningful relationships. Apparently, the number of adults, especially females, negatively influenced recapture of several age-sex classes. Males had less influence than females on recapture; sometimes their influence was positive. Until further work is performed, however, we can make few definite conclusions. Presently we are running a field experiment to test the hypothesis that the presence of adults influences the survival of all age classes, especially the young.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R.L. Westemeier,
J.E. Buhnerkempe

Wildlife biologists usually study cover preferences of wildlife to increase wildlife populations through habitat management. In our case, however, a comparison of cover preferences is needed to maximize use of the sanctuaries by prairie chickens and minimize benefits to pheasants. Increasing numbers of pheasants on the sanctuaries underlies the need for this study (IWRL 24(11):2-3). Annual nest searches on sanctuaries in Jasper County provide insight on comparative cover preferences by the 2 species.

Among the 4 major grass types on the sanctuaries, densities per 10 acres for 530 prairie chicken nests were brome, 2.6; timothy, 1.5; redtop, 1.3; and prairie grass, 0.9. The densities per 10 acres for 72 pheasant nests were prairie grass, 0.4; brome, 0.3; timothy, 0.2; and redtop, 0.1. Thus, lowest densities of prairie chicken nests but highest densities of pheasant nests were found in prairie grasses (switchgrass, Indiangrass, and big bluestem).

Observations made during prescribed burning of prairie grasses at Bogota also indicate high use by pheasants. A minimum mean of 0.4 pheasant per acre was flushed during burning of 14 fields totaling 141 acres of prairie grass during the winters of 1979 through 1981. The only field from which no pheasants were observed flushing had been rotary mowed the previous August; all other fields were rank undisturbed stands of prairie grass. No prairie chickens were observed flushing from any of the 14 fields.

Apparently, prairie grass has fostered the survival of pheasants at Bogota more than any other cover type. Some modifications in the management of prairie grasses on sanctuaries might help control pheasants at Bogota. Instead of burning in late winter (March), prairie grass stands could be burned in November or December to help disperse pheasants to private land where the birds would be more available to local hunters. Prairie grasses not scheduled for burning should be grazed or mowed in late summer to a height of 30 to 40 cm to (1) facilitate capture by nightlighting, (2) reduce the concealment value to pheasants and to predators, and (3) to enhance use of such fields by prairie chickens. Late summer mowing of prairie grasses would include fields that have regrown following haying in July. One can argue that some prairie grass acres should be seeded back to stands of redtop, timothy, and brome. However, many fields have been seeded to prairie grass to control erosion. We should not have to be limited to the use of cool season grasses in preservation efforts for prairie chickens.

Ecology and Management of White-tailed Deer - W-87-R C.M. Nixon, L.P. Hansen,
J.E. Chelsvig, P.A. Brewer

The winter home ranges of 4 adult does in the vicinity of Allerton Park are described in Table 1. Winter habitat use for the same 4 deer (Nos. 242, 316, 336, and 338) was described in August (HWRL 24(3):4).

A protected wheat field that bordered the Park was used extensively by Deer 316, particularly at night. Deer 242 and 338 lived on the north side of the Park near unplowed corn and soybean fields that were a source of waste grain. These deer also used a wheat field for grazing and as a travel lane to small patches of cover outside the Park. Unplowed stubble and wheat fields apparently influence the winter habits of some deer.

The range of deer 336 is markedly smaller than the ranges of the other deer. This deer made little use of agricultural products, which may account for her small range. She continued this limited use of crops through the summer to the present and has tended to stay deep within the Park. She has not been observed along roads or in the fields since April.

The first part of the paper discusses the importance of the study and the objectives of the research. It also mentions the scope of the study and the limitations. The second part of the paper discusses the methodology used in the study. It mentions the data sources and the statistical methods used. The third part of the paper discusses the results of the study. It mentions the findings and the conclusions. The fourth part of the paper discusses the implications of the study. It mentions the policy implications and the future research.

The study was conducted in a systematic and rigorous manner. The data was collected from a representative sample of the population. The statistical methods used were appropriate for the data and the research objectives. The results of the study are presented in a clear and concise manner. The findings are discussed in detail and the conclusions are drawn based on the evidence. The implications of the study are discussed in a way that is relevant to the policy makers and the researchers. The study is a valuable contribution to the field of research and it provides a solid foundation for future research.

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Table 1. Characteristics of minimum winter home ranges of radio-monitored, adult, female, white-tailed deer, 1 January to 31 March 1981.

| Tag number | Area | | Major axis | | Minor axis | | Percent of range in cropland | Number of observations |
|------------|----------|-------|------------|-----|------------|-----|------------------------------|------------------------|
| | Hectares | Acres | km | mi | km | mi | | |
| 316 | 109 | 269 | 1.8 | 1.1 | 1.1 | 0.7 | 14.2 | 122 |
| 336 | 82 | 203 | 1.8 | 1.1 | 0.8 | 0.5 | 8.5 | 84 |
| 338 | 117 | 289 | 1.9 | 1.2 | 1.2 | 0.8 | 17.1 | 78 |
| 243 | 108 | 267 | 2.3 | 1.4 | 1.8 | 1.1 | 19.9 | 52 |

Cooperative Waterfowl Research - W-88-R

F.C. Bellrose, S.P. Havera,
G.A. Perkins, H.K. Archer

Effective long-term management of Illinois' migratory waterfowl resource, as with other wildlife species, can best be accomplished by maintaining and improving existing habitat in the state. A most important habitat characteristic is the quality and availability of food items. To identify the foods most used by Illinois waterfowl, we collected gizzards from cooperators during the 1979 and 1980 hunting seasons. Mallards accounted for 74% of all duck-days along the Illinois and Mississippi rivers during the 32-year period of 1942 through 1979; therefore, that species was selected for extensive food-habits analysis. A total of 7,022 mallard gizzards was collected from 37 sites with the following distribution: Illinois River areas--19 sites, 4,632 gizzards; Mississippi River areas--11 sites, 1,203 gizzards; Central and Southern Illinois Reservoirs--6 sites, 1,137 gizzards; and Northeastern Illinois--1 site, 50 gizzards. Mallard gizzards were collected each week to allow analysis of temporal as well as regional variation in food-use. A total of 197 species (117 genera) of plant foods and about 25 species of animal foods were identified. The food-habits data are being entered on computer tapes for analysis. Additional gizzards will be examined from the 1981 hunting season from areas not sufficiently represented.

Results of the present study will be compared with those of Anderson (1959; INHS Bulletin 37(4):344) to assess changes in food-use by Illinois mallards over the last 40 years. This information will help waterfowl managers maximize the quality of existing waterfowl food resources.

MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

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Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

The use of chlorinated hydrocarbon insecticides in Illinois agriculture greatly expanded from the late 1950's through the late 1960's. Expanded use of these environmentally persistent compounds corresponded with the period in which a decline in the survival of pheasant chicks was most apparent.

In 1976-77 we collected 20 pheasant chicks from different broods in Ford and Livingston counties to determine the presence of metabolites from chlorinated hydrocarbon insecticides. The INHS Wildlife Pesticides lab monitored concentrations of p,p' - and o,p' -DDE (metabolites of DDT), dieldrin (metabolite of aldrin), and heptachlor epoxide (metabolite of heptachlor). DDT was curtailed for agricultural use in the mid-1950's, aldrin and heptachlor were used extensively through the early 1970's and were curtailed in 1978.

Research in east-central Illinois and elsewhere in the Midwest indicates that the reproduction and survival of pheasants may be impaired by the ingestion of dieldrin. Pheasant chicks are potentially exposed to dieldrin and similar metabolites in the embryonic stage, and by ingestion of insects and soils beginning immediately after hatching.

Table 1 shows the mean metabolite concentrations of aldrin, DDT, and heptachlor for pheasant chicks collected in 1976-77. Compared with a similar sample of pheasant chicks collected from the same region in 1968 (U.L. Anderson et al. 1970. Ill. State Acad. Sci. 63:373-382), concentrations of metabolites in 1976-77 appeared much lower for p,p' -DDE, slightly lower for dieldrin, and similar-to-slightly-lower for heptachlor epoxide. However, the upper ranges of some of the metabolite concentrations found in 1976-77 were similar to those documented in 1968. Some of the higher concentration values detected in 1976-77 could potentially limit reproduction and survival if the inferences made from previous benchmark studies of survival are correct.

Whether the widespread application of chlorinated hydrocarbons is or is not related to a decline in the survival of pheasant chicks will best be tested in the future. Because aldrin and heptachlor have not been used since 1978, concentrations of their metabolites in the environment are diminishing. For example, concentrations of dieldrin in the soil in Illinois are already 10 ppb. Survival of pheasant chicks should eventually increase if chlorinated insecticides have been a major contributor to mortality.

Table 1. Mean concentrations of metabolites of chlorinated hydrocarbon insecticides detected in pheasant chicks collected in Ford and Livingston counties, 1976-77. The average age of pheasant chicks sampled was 3.5 weeks; ages ranged from 2 days to 10 weeks.

| | N | $\bar{X}$ (ppm) ^a | Frequency |
|--------------------|----|------------------------------|-----------|
| Heptachlor epoxide | 20 | .0191 | 20 |
| p,p'-DDE | 20 | .0208 | 19 |
| o,p'-DDE | 20 | .0090 | 7 |
| Dieldrin | 20 | .0274 | 20 |

^a $\bar{X}$ concentrations represent whole body samples for 13 chicks $\leq$ 26 days of age, and liver-muscle-heart-brain samples for 7 chicks $\geq$ 27 days.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

Wildlife biologists cite reproduction, survival, and immigration as factors that strongly affect numerical change in populations. Unfortunately, how much each of these demographic parameters impacts densities is seldom evaluated. To make such an evaluation, a sensitivity analysis was performed on data gathered during a 7-year study of fox squirrels.

We calculated means and coefficients of variation for survival, reproductive, and immigration rates during the 7-year study period. When the mean values were put into a rate-of-change equation (Table 2), an average rate of increase could be calculated. The deviation from this mean rate of increase, produced when 1 of the demographic parameters was varied (over the range of values observed during the 7-year study) while the other parameters were held constant at their mean values, was an indication of the impact of this variable on numerical change. This process was repeated for all of the demographic parameters.

Survival of fox squirrels from birth to 0.5 year varied most from year to year and potentially had the largest impact on density change. Survival of adults also strongly affected numerical change; however, adult survival varied little relative to the other demographic parameters. The other demographic parameters (see equation) had lesser impacts on density change than survival of nestling and adult squirrels.

These results are from an unexploited fox squirrel population; results from exploited populations might differ somewhat. Our results indicate that to maintain sizable squirrel populations, management should first try to increase survival of young and adults, because they most strongly impact density changes.

Table 2. Rate of increase equation.

$$\lambda = \text{SSA} + \text{SYR} + \text{SAD} + \text{IM} + \frac{S_{0-0.5} (\text{PROD}_{\text{AD}})}{\text{TOTAL}} + \frac{S_{0-0.5} (\text{PROD}_{\text{YR}})}{\text{TOTAL}}$$

where

- λ = rate of change
- SSA = survival of subadults
- SYR = survival of yearling
- SAD = survival of adults
- $S_{0-0.5}$ = survival from birth to 0.5 years
- PROD_{AD} = adult natality
- PROD_{YR} = yearling natality
- Total = total fox squirrels

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R.L. Westemeier,
J.E. Buhnerkempe

Since 1965, 53 prairie chicken nests were found on the sanctuaries at Bogota in a cumulative total of 277 ha (685 acres). The sanctuaries were dominated by prairie grass (mostly switchgrass, Indiangrass, and big bluestem). We indicated last month (MWRL 24(12):2-3) that use of prairie grass was low for prairie chickens but high for pheasants compared with use of redtop, timothy, or brome; type of grass management was not considered.

Prairie grasses are managed between nest seasons by one or a combination of several methods. In winter they may be prescribe-burned, in mid-July they may be hayed, and in late summer they may be mowed for weed control, mowed to enhance nesting, combined for seed, or left undisturbed.

Mowing to control weeds or enhance nesting and combining for seed each results in a tall (35-45 cm) stubble and a similar litter depth. Data for mowing and combining were grouped and resulted in 1.5 established prairie chicken nests per 4 ha (10 acres) and 0.8 hatched nest per 4 ha. Nest densities and nest success rates for the mowed types of prairie grasses were at least twice as high as for the undisturbed (0.8 and 0.2), hayed (0.6 and 0.2), and burned (no nests) categories.

Since 1969, 21 pheasant nests have been found in a cumulative total of 645 acres of prairie grass on the sanctuaries at Bogota. For these pheasant nests, there was little difference in rates of establishment among undisturbed (0.3/4 ha), mowed (0.4/4 ha), and hayed (0.3/4 ha) prairie grass. No pheasant nests were found in prairie sods burned the previous winter, and no prairie chicken nests were found.

Apparently, mowed prairie grass is as acceptable to nesting prairie chickens as redtop and timothy. Pheasants, however, show no particular preference for mowed prairie grass. These findings suggest that if prairie grasses are to be maintained on sanctuaries, they should be rotary mowed or combined for seed to maximize use by prairie chickens. However, rotary mowing is becoming increasingly difficult to justify from the standpoints of energy conservation and economics. Likewise, harvesting by combine is currently not feasible because of the limited demand for prairie grass seed.

Limited grazing may offer the best alternative to mowing, haying, or no management of prairie grasses. Grazing of prairie grasses was initiated on a small scale in Jasper and Marion counties in 1981.

Ecology and Management of White-tailed Deer - W-87-R

C.H. Nixon, L.P. Hansen,
J.E. Chelsvig, P.A. Brewer

The first step in identifying areas of deer concentration in the northern two-thirds of Illinois was an aerial survey of winter concentration areas in Ford County, 14 January 1982. Possible areas of concentration were identified from aerial photographs, topographic maps, and district biologist's reports. These areas were surveyed from a fixed-wing aircraft flying at an altitude of approximately 500 ft (170 m). Conditions for aerial observation of deer were nearly ideal: 6 in (15 cm) snow cover, low temperature (4°F [-14°C]), and overcast skies.

Ford County has the least forest cover of any county in the state (0.55%, Illinois Dept. of Conservation data). Not surprisingly, only 2 concentrations of deer were found. The first area, located 4 mi (6.4 km) south of Piper City, contained only 6 deer but, due to the small amount of habitat available, was considered a possible concentration. The second concentration was 5 mi (3.0 km) west of Paxton and held 13 deer. These deer were in a brushy area adjacent to a field of standing corn, which probably influenced the site of the concentration.

Aerial photographs and observation of the areas on foot will be used to estimate the total land area occupied by these concentrations of deer. Aerial surveys of other central Illinois counties are scheduled for this winter if weather and snow cover permit.

Cooperative Waterfowl Research - W-38-R

F.C. Bellrose, S.P. Havera,
G.A. Parkins, H.K. Archer

Aerial waterfowl censuses conducted by Robert Crompton from September through December of 1981 revealed unusually low numbers of ducks in the Illinois and Mississippi river valleys for the second consecutive season (MWRL 24(1):6). Duck numbers in the Illinois River valley peaked at 495,000 birds on 1 December 1981, less than the 1980 peak of 544,000 birds and only half of the 1978-1980 average

fall peak. Mallards constituted 90% of the peak in 1981, compared with 80% for the 1978-1980 average peak. The slightly higher proportion of mallards in 1981 is probably a result of the late population buildup. Fall migration numbers usually peak around the third week of November in the Illinois Valley when more of the early migrants such as teal, pintail, wigeon, and gadwall are present.

Duck numbers reached an early peak of 847,000 birds on 26 October 1981 in the central Mississippi Valley (Grafton to Rock Island). This concentration, comprised primarily of diving ducks, was slightly lower than the peak of 948,000 on 3 November 1980 and considerably lower than the 1978-1980 average fall peak of 1.4 million birds. Peak mallard numbers (342,000 on 23 November 1981) were also down in the Mississippi Valley from the 1978-1980 average peak of 656,000.

Locations most used by ducks changed little in 1981 from previous years. Goose Pond (Bureau County), Hitchcock Slough, Grand and Cuba islands, and Senachwine, Peoria, Powerton, Big, Chautauqua, Crane, Meredosia, Flat, and Swan lakes hosted the most ducks in the Illinois Valley. In the central Mississippi Valley, ducks preferred the Keokuk Pool, water areas in St. Charles County, Missouri, and Oqwawka, Keithsburg, Louisa, Batchtown, Cannon, Delair, and Shanks refuges.

The decrease in the 1981 duck populations in the Illinois and Mississippi valleys was expected by duck hunters and biologists. Another poor hatch of young on the breeding grounds combined with poor food resources resulting from the high water conditions of summer (MVRL 24(11):4) are major factors responsible for the decline.

MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

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Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

If metabolites of agricultural insecticides have contributed significantly to reducing the size of pheasant broods over the past 3 decades, then 1 possible manifestation would be a reduced rate of hatch. For example, controlled studies have demonstrated that pheasants that ingest high levels of chlorinated hydrocarbons produce fewer eggs and fewer of the eggs hatch.

The clutch size (incubated nests) and number of eggs hatched per successful nest for pheasants near Sibley apparently have remained relatively constant since the mid-1950's (Table 1). Therefore, if insecticides have impaired survival of pheasant chicks, the chicks appear most vulnerable in the post-embryonic stages.

The "clean farming syndrome"--high use of chemicals on farmland--alters habitat and therefore tends to reduce the rate of survival by pheasant chicks. Next month we will discuss the components of habitat essential for pheasant broods and how they are affected by changing agricultural practices.

Table 1. The average number of pheasant eggs incubated and hatched per nest near Sibley, Illinois, 1955-81.^a

| Period | $\bar{X}$ eggs per nest | | N |
|---------|-------------------------|---------|-----|
| | Incubated | Hatched | |
| 1955-59 | 9.9 | 8.5 | 297 |
| 1960-64 | 9.9 | 8.6 | 684 |
| 1965-69 | 10.1 | 9.0 | 200 |
| 1970-74 | 9.3 | 8.3 | 236 |
| 1975-81 | 9.3 | 8.3 | 58 |

^aData for 1955-72 from the Sibley Study Area; 1973-81 from the Ford County Management Unit.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

The literature indicates that fox squirrel populations have 2 reproductive periods each year--1 in spring and 1 in summer--and that most adult females participate in each breeding period. Unfortunately, much of this literature is anecdotal or at best incomplete. We collected data from 14 breeding periods on a study site near Danville (see previous newsletters). Breeding rates of adult fox squirrels (≥ 1.5 years old) were higher during spring (68%) than during summer (49%). Generally, a small proportion of yearlings had young during the spring (0-67%), whereas no yearlings reproduced during the fall. About 28% of the adult female fox squirrels that reproduced had litters during both spring and summer of the same year, 39% had litters only in spring, and 33% had litters in fall only (Table 2). Table 2 also indicates that seasonal and annual variability rates were high. These results are from an unexploited population and results from an exploited population may differ. Regardless, it appears that reproductive rates of individual fox squirrels are low. In next month's newsletter, we will look at potential causes of seasonal and annual variability in reproductive rates.

Table 2. Frequency of breeding in adult female fox squirrels. Only females for which breeding histories are known for both spring and fall are included.

| Year | N | Spring only | Fall only | Both fall and spring | Neither fall nor spring |
|------|----|-------------|-----------|----------------------|-------------------------|
| 1971 | 10 | 3 | 3 | 4 | 0 |
| 1972 | 19 | 2 | 9 | 1 | 7 |
| 1973 | 17 | 7 | 4 | 1 | 5 |
| 1974 | 13 | 3 | 4 | 1 | 5 |
| 1975 | 14 | 2 | 3 | 9 | 0 |
| 1976 | 14 | 10 | 3 | 1 | 0 |
| 1977 | 10 | 4 | 0 | 5 | 1 |

Responses of Prairie Chickens to Habitat Manipulation - W-66-R

R.L. Westemeier,
J.E. Buhnerkempe

Pheasants are a serious threat to the survival of prairie chickens near Bogota in Jasper County, according to recent studies (MWRL 24(11):2-3). Capturing pheasants by nightlighting and removing them from the sanctuaries has been suggested as 1 means of control (MWRL 24(3):3-4). How effectively capture and removal will control pheasants depends on the rate at which the vacated habitat is reoccupied by pheasants from surrounding areas. Available data indicate that the rate of reoccupancy would be relatively slow.

Some 32 sections of sanctuaries near Bogota have been systematically surveyed each year since 1963 for both prairie chickens and pheasants (MWRL 24(4):2-3 and 24(6):2-3). The estimates for pheasants were conservative through 1980, but standard methods for censusing pheasants were employed in 1981. On the 1.6 mi² (4.1 km²) of sanctuaries, pheasants gradually increased from none in 1963-68 to 32 crowing cocks in 1981. On the 30.4 mi² (77.8 km²) of nearby private land, pheasants increased from essentially none in 1963-68 to 16 cocks in 1981. Densities of pheasants in 1981 were 20 cocks per mi² (2.6 km²) on sanctuaries compared with only 0.5 cock per mi² on nearby private land. Data provided by R. E. Warner from reports by rural mail carriers also indicate low numbers of pheasants in Jasper County generally. Pheasants observed per 100 miles by mail carriers were 1.0, 0.1, 0.0+, 0.0+, and 0.1 in April 1958, 1963, 1968, 1973, and 1978, respectively, in Jasper County. In Smallwood Township, where the Jasper County prairie chicken sanctuaries are located, the mail carriers reported, respectively, 1.4, 0.0, 0.0, 0.0, and (surprisingly) 0.0 pheasants per 100 miles for the same years.

Thus, the pheasants at Bogota appear to be a local population that is strongly dependent upon sanctuary habitat. Nightlighting would probably be most feasible on those sanctuary fields used for nightroosting by pheasants and little used by prairie chickens. In 2 or 3 good nights, 2 men in 1 nightlighting rig might capture a sufficient number of pheasants to achieve a satisfactory level of control. Nightlighting should be tried in combination with various forms of habitat manipulation (MWRL 24(12):2-3 and 25(1):3-4) to control pheasants on the sanctuaries at Bogota.

Errata

The first 2 sentences in last month's newsletter should have read:

Since 1965, 53 prairie chicken nests were found in prairie grass on the sanctuaries at Bogota in a cumulative total of 277 ha (685 acres). The dominant prairie grasses were switchgrass, Indiangrass, and big bluestem.

Ecology and Management of White-tailed Deer - W-87-R

C.M. Nixon, L.P. Hansen,
J.E. Chelsvig, P.A. Brewer

Areas of winter deer concentration were identified by aerial survey 14 January 1982 in Ford County (MWRL 25(1):4) and in Champaign County. Agriculture is the primary land use in Champaign County; forest covers only 1.17% (7,507 acres) of the total area (Illinois Dept. of Conservation data). Champaign County however, has much more forest cover than Ford County (1,740 acres), so it is not surprising that more concentrations of deer were found in Champaign County. Areas that contained 10 or more deer were considered winter concentrations.

Concentration areas were located as follows: 2 mi (3.2 km) NE Mahomet, 3 mi (4.8 km) NE Fisher, 6 mi (9.6 km) N Penfield, 3 mi (4.8 km) NW Homer (Homer Lake Park), and 3 mi (4.8 km) W Homer. The Mahomet and Fisher areas each held

about 20 deer and lie in the Sangamon River drainage. The Penfield area is in the Middle Fork of the Vermilion River drainage and held about 40 deer. There were about 20 deer in each of the 2 areas near Homer in the drainage of the Salt Fork of the Vermilion River.

In future field work we hope to define the size of the concentration areas and identify the features of the habitat that attract deer. Aerial surveys of other counties are planned.

Cooperative Waterfowl Research - W-88-R

F.C. Bellrose, S.P. Havera,
G.A. Perkins, H.K. Archer

Each year state and federal biologists and qualified volunteers across the nation conduct the Winter Waterfowl and Eagle Survey by land, water, and air. This cooperative nationwide survey begins the 1st Monday of the year and is completed when local weather conditions permit during the following 4 days. This census serves as a rough index to yearly changes in the populations of ducks, geese, swans, coots, and bald eagles and also delineates their winter distribution.

In Illinois, Robert Crompton of the Havana Laboratory participated during January in the Winter Waterfowl and Eagle Survey by aerially censusing the Illinois and Mississippi river valleys and various selected reservoirs and cooling lakes throughout the state. Illinois winter censuses vary substantially from year to year because of weather; therefore, we have compared the 1982 totals with 1977-81 5-year averages for evaluation.

Ducks surveyed in the Illinois River valley in winter 1982 totaled 108,000, a decrease of 33% from the 5-year average. In the Mississippi River valley there were an estimated 130,000 ducks, a 4% decrease from the 5-year average. Censuses of reservoirs and cooling lakes across the state revealed a 29% increase in birds in northeastern Illinois and an 88% decrease in the central and southern part of the state. The total number of ducks in the Illinois winter survey decreased 29% in 1982 from the 1977-81 average, a reduction that was expected because of the low totals for fall 1981.

Eighty-five hundred Canada geese, 1,500 of which were the giant race, were observed on the Illinois River valley in the winter survey as compared to 16,500 on the Mississippi River. These totals represented a 95% increase and a 6% decrease respectively, from the 5-year averages. Canada goose numbers were up dramatically on the cooling lakes and reservoirs outside the quota zone in central and southern Illinois (65,000 in 1980 to 126,600 in 1981) and increased 71% statewide over the 1977-81 average. Few snow geese were censused in the 1977-81 winter surveys, but 6,500 were observed in the St. Louis area of the Mississippi River during the 1982 inventory. Insignificant numbers of coots winter in Illinois.

The 175 bald eagles counted in the Illinois River valley during the 1982 winter survey represented a 24% decrease from the 1977-81 average. In the Mississippi River valley, bald eagle numbers were up 11% to 420 over the 5-year

average of 379. Only small numbers of bald eagles disperse to cooling lakes and reservoirs in Illinois and contribute little to the statewide population.

The 1982 survey indicated a decrease in numbers of waterfowl wintering in Illinois with the bulk of this decrease occurring in the Illinois River valley. More geese were observed than in past years, especially at the scattered cooling lakes and reservoirs in central and southern Illinois.

Results from the Winter Waterfowl and Eagle Survey will provide a better understanding of population dynamics and distribution of the censused species.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Champaign, Illinois

March, 1982

Vol. 25, No. 3

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Pheasants were counted by helicopter on 5 study areas in east-central Illinois during the winter of 1981-82. Counts of <5 pheasants per section were registered for all areas (Table 1). The 1981-82 counts are perhaps unusually conservative because most flights were made shortly after a major snowfall. Pheasants had not resumed feeding in open areas at the time of the censuses.

The numbers of pheasants on the areas remain severely depressed, as they have been since the severe winter storms of the late 1970's. Because most of the areas are devoted nearly exclusively to corn and soybean farming, pheasants will probably not increase substantially.

Table 1. Pheasants counted by helicopter on 5 study areas in east-central Illinois. (Illinois Department of Conservation personnel [W-85-D] assisted with the counts.)

| Area | Pheasants per square mile | |
|---------------|---------------------------|-----------------------------|
| | January-February 1979 | December 1981-February 1982 |
| SSA | 1 | 1-2 (29 December 1981) |
| FCMU | 7 | 2-3 (13 January 1982) |
| Anchor | 1 | <1 (29 December 1981) |
| Harwood | (no census) | 3-4 (13 January 1982) |
| Prairie Green | 2 | 2-3 (11 February 1982) |

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

Last month (MWRL 25(2):2) we reported that reproductive rates of adult female fox squirrels vary widely, both seasonally and annually. Knowledge of the causes of this variability is important not only biologically but also from a management standpoint.

Several researchers have noted a relationship between breeding rates and mast abundance. On our study site near Danville, however, correlations between breeding rates and production of white oak, black oak, red oak, and hickory seeds revealed no consistent relationships during the spring or fall. Apparently, mast abundance did not affect reproductive rates on that area.

Weather conditions during the breeding period also have been implicated as important factors affecting reproductive rates. In our study, correlations between temperature and precipitation in the breeding periods (June and December-January) and reproductive rates in the following periods (summer and spring, respectively) revealed no significant results, although June precipitation ($r = -0.561$) and December temperature ($r = -0.571$) exhibited rather high negative correlations.

Finally, we evaluated the effect of population size on reproductive rates. Yearling and adult breeding rates were positively correlated and both were negatively related to adult and total population size the previous season. Yearling breeding was most highly correlated with population size ($r = -0.80$) suggesting that yearlings may be more sensitive to population density.

Although the correlations performed do not demonstrate causative relationships, they suggest that reproductive rates may be negatively affected by population size. The large amount of variation in reproductive rates not accounted for by population size, however, suggests that a complex of factors, which may include weather conditions and food abundance, probably determines reproductive rates.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R.L. Westemeier,
J.E. Buhnerkempe

Between 1963 and 1981, 6,047 acres of grasslands were searched on foot for nests of 15 grassland-nesting species at Bogota. Redtop covered the most area (3,129 acres) and brome the least (282 acres). The 6 basic cover types used to provide nest habitat for prairie chickens were ranked according to nest densities. For 716 established chicken nests, the high-to-low ranking of cover was brome, timothy, weedy grassforbs (dominant species not readily apparent), redtop, prairie grasses (switchgrass, Indiangrass, and big bluestem), and wheat stubble-red clover.

For 101 pheasant nests found during the annual nest searches from 1969 through 1981 at Bogota, the high-to-low ranking of cover was brome, weedy grassforbs, prairie grass, timothy, redtop, and wheat stubble-red clover. Both prairie chickens and pheasants used all 6 cover types and both apparently preferred brome. Brome also ranked high in nests of red-winged blackbirds and dickcissels, but relatively low in nests of bobwhite, meadowlarks, upland sandpipers, cottontails, and small mammals.

Because of high use by nesting prairie chickens, brome merits increased consideration in prairie chicken management. Can brome be economically managed

to discourage the troublesome pheasant and still be attractive to prairie chickens? To date, the various management categories of brome that we have searched for nests include: undisturbed, 161 acres; rotary mowed, 50 acres; light-grazed, 36 acres; or recent burned, 32 acres. Sixty-nine prairie chicken nests and 12 pheasant nests were found in fields dominated by brome. Chickens nested successfully in all 4 management categories of brome, but nest establishment and nest success were highest in rotary-mowed fields. Rotary-mowed prairie grass also showed higher use by nesting chickens than undisturbed, hayed, or recently burned prairie grass (MWRL 25(1):3-4). Sample sizes of pheasant nests are still too limited to show significant differences among the 4 management categories for brome; however, during 2 years, 1 18-acre field of lightly grazed brome showed high use by nesting pheasants.

Brome not only is attractive to nesting chickens, but it has good longevity. One 14-year-old brome meadow at Bogota was still attractive to chickens in 1981, although invasion by Solidago sp. and Rubus sp. is progressing. By contrast, redtop or timothy meadows seldom last more than 10 years before plowing, row cropping, and reseeding are necessary. A disadvantage of brome is that it lacks the economic value of redtop seed. It is desirable to try fertilization and delayed haying as an additional approach to managing brome for nesting chickens and other wildlife.

Errata

The 1st sentence of the 2nd paragraph in last month's newsletter should have read: "Some 32 mi² (81.0 km²) including the sanctuaries near Bogota"

Ecology and Management of White-tailed Deer - W-87-R

C.M. Nixon, L.P. Hansen,
J.E. Chelsvig, P.A. Brewer

True, accurate censuses of wildlife populations can be difficult to obtain. A reasonably accurate census of deer can be made by counting the deer on a given area from a helicopter when there is sufficient snow cover (15-20 cm, 6-8 in).

Deer were censused by helicopter in Allerton Park and vicinity 18 December 1981, almost 1 week after the firearm-hunting season closed. The area censused included approximately 10 km (6 mi) of the Sangamon River SW of Monticello in Piatt County. Snow cover was approximately 20 cm (8 in); 79 deer were observed. During the 2nd helicopter census of this area, 14 February 1982, snow cover was approximately 50 cm (20 in); 124 deer were sighted, an increase of 57% over the December count.

This information seems to indicate that Allerton Park is a major winter concentration area in east-central Illinois and that many deer do not move into the concentration area until sometime after the hunting season. Firm conclusions cannot be drawn from 1 pair of censuses. Future counts are planned if there is enough snow cover.

Cooperative Waterfowl Research - W-88-R

F.C. Bellrose, S.P. Havera,
G.A. Perkins, H.K. Archer

To understand the need for prudent management of Illinois' remaining wetland habitats for waterfowl, both the historical and current status of these areas must be evaluated. In the mid-1800's, approximately 4 million ha (10 million acres) of pristine wetlands remained in Illinois--28% of the total land area. Besides the extensive bottomlands of the Mississippi and Illinois rivers, this acreage included the periphery of the great Kankakee Marsh in the Kankakee River drainage, the Winnebago Marsh in the Green River watershed, and large deep marshes in Logan and Mason counties. These marsh areas, which totaled over 600,000 ha (1.5 million acres), along with millions of acres of wet meadows in the Big Prairie region of central Illinois are virtually non-existent today. Seasonally flooded cypress/mixed hardwood forests once occupied about 100,000 ha (250,000 acres) of the Wabash, Cache, and Mississippi river bottomlands in southern Illinois; as of 1973, only about 5,100 ha (12,600 acres) remained (Graber and Graber 1976. INHS Biol. Note 97).

Illinois wetlands were last inventoried in 1955 and the findings were included in "Wetlands of the United States" (USFWS Circular 39, 1956). That inventory documented wetlands in 55 counties that contain over 90% of Illinois' wetland habitat. For the remaining 47 counties, the types of wetland habitat were established. The inventory identified about 173,000 ha (427,000 acres) of wetlands representing open fresh water, seasonally flooded wetlands, shallow marshes, deep marshes, fresh meadows, shrub swamps, and wood swamps (in that order). In addition to these "true" wetlands, about 100,000 ha (248,000 acres) of seasonally flooded agricultural lands and 28,000 ha (68,000 acres) of streams and impoundments were identified. An additional 11,300 ha (28,000 acres) of less important wetlands were estimated to be in the counties not inventoried.

Accurate up-dated information on wetlands important to waterfowl in Illinois is necessary to provide a habitat data base for management. A current inventory will provide information on the potential "carrying capacity" of waterfowl in the state. By analyzing recent changes in distribution, status, and quality of wetlands in concert with waterfowl population changes and current food habits, an effective management scheme can be formulated. In addition, policy makers and planners can be supplied with information in a format that can be used effectively to make sound decisions for acquiring and protecting critical wetland habitats.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Champaign, Illinois

April, 1982

Vol. 25, No. 4

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

The survival of pheasants on the Sibley Study Area (SSA) during the 1960's was recently analyzed with the assistance of S. L. Etter, former leader of the pheasant project. One aspect of the analysis focused on factors that were potentially important in determining rates of survival for several thousand pheasants backtagged from 1962 through 1965. This period is historically important because of the rapid transition to the row-crop monoculture that currently prevails in central Illinois.

For pheasants captured and backtagged in the falls of 1962 through 1965, rates of observation were considered relative to year-to-year changes, location of capture site on the SSA, and characteristics of molt, age, and weight. The average percentage of birds observed alive after 1 January of each year (following capture) was 42% for adult hens, 27% for juvenile hens, and 7.9% for juvenile cocks.

The relative importance of the variables considered for each sex and age cohort was determined by a regression model, MANOVA. For adult hens (N = 714), molt stage at capture, date of molt initiation, and body weight were not significantly related ($P > 0.05$) to the observation rate. For juvenile hens (N = 1,445), weight was also not related to observation rates, but age at capture and date of hatch were significantly ($P < 0.05$) related to rates of observation. Date of hatch--the most important factor--indicates that earlier-hatched young are more likely to survive until winter. Controlling for other factors, for 2 groups of juvenile hens hatching 1 week apart, the older group would be predicted to have a 3% greater rate of survival through 1 January following hatch.

Two analyses were performed for juvenile cocks (N = 1,356)--one for cocks known alive at the onset of the hunting season and the other for cocks observed 1 January or later (i.e., alive following the hunting season). In both analyses, weight, date of hatch, and age at capture were not related significantly to rates of observation.

In next month's newsletter we will consider the importance of the location of the capture site on the SSA and survival--the importance of egress.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

In our studies of the effects of nest boxes on fox squirrels, we rarely found females of breeding age in nest boxes but frequently found adult males in them. Because adult males are usually dominant in social encounters with females, we speculated that adult males may exclude breeding females from nest boxes.

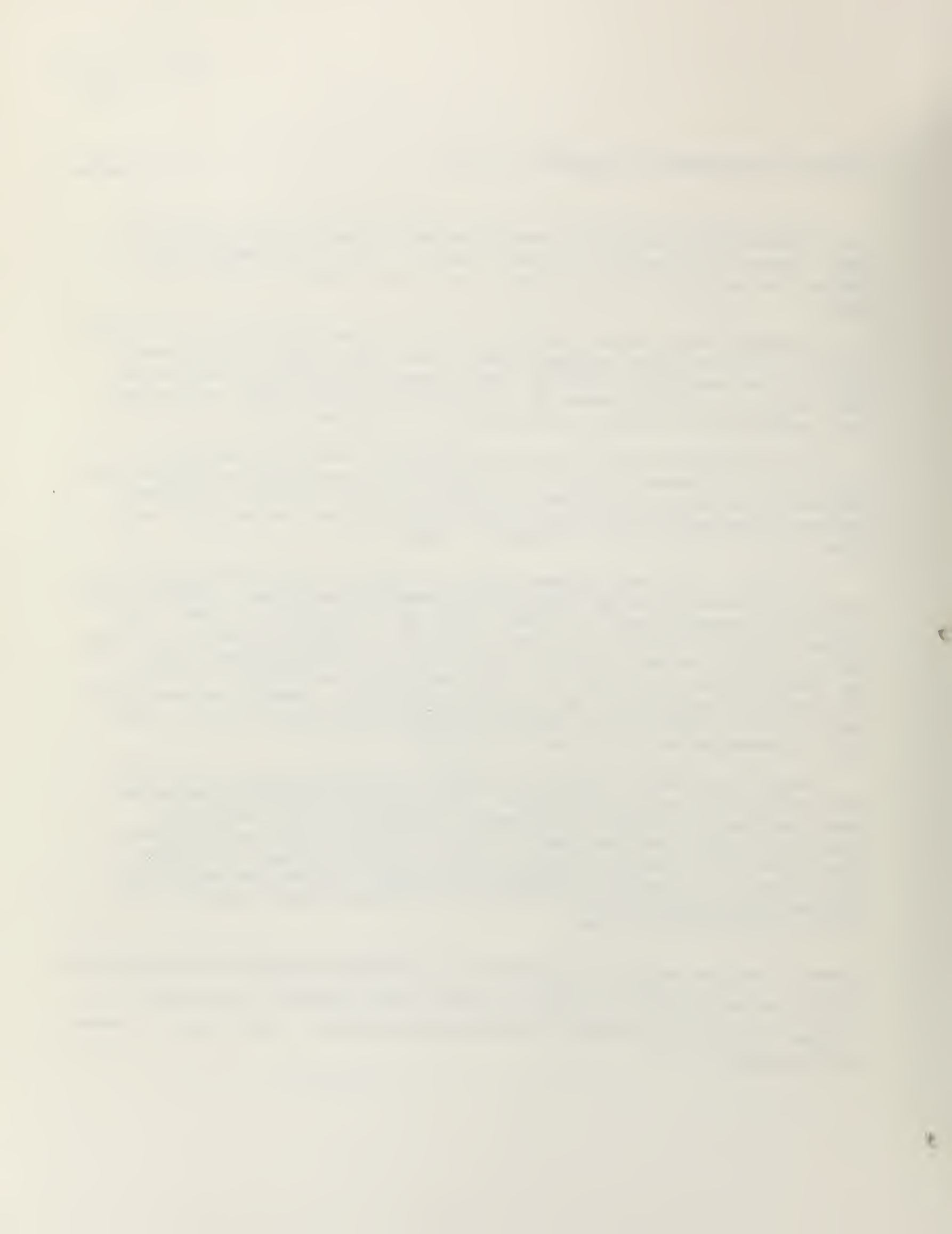
To better assess shelter selection by the various age classes, we collected squirrels from leaf nests and nest boxes in late winter 1978 from our study area in Vermilion County, Illinois. We destroyed all leaf nests and emptied nest boxes; we then livetrapped the area intensively for 2 weeks and assumed that captured squirrels were sheltering only in tree cavities.

Breeding females were as likely to be found in leaf nests and tree cavities as adult males (Table 1). Subadults also have access to tree cavities, presumably the shelter favored by all segments of the population. Subadult and adult females were most often found in tree cavities, whereas males were found equally as often in all 3 shelters (Table 1).

We believe that breeding-aged females avoided our nest boxes because of inherent deficiencies in the design and placement of the boxes. Leaf nests used to shelter preweaned young are usually found 50-70 feet high in trees. We believe this is an attempt to prevent predation of young by raccoons, opossums, and the climbing snakes, which are less likely to reach high-placed nests. If our boxes had been placed higher in the tree canopy, we probably would have improved the occupancy rate for breeding-aged females. However, we would have had difficulty checking these boxes and capturing squirrels in them at night when we conducted many of our nest box checks.

Male fox squirrels, without the demands of rearing young, can be less discriminating in nest site selection. They appear to tolerate other males more than females tolerate other females; subadult and adult males were frequently found in the same nest in winter. Females were always solitary when captured in a shelter, except for an occasional instance of a female found with 1 or 2 juveniles, presumably her young. For maximum benefit for fox squirrels, nest boxes should be placed as high in trees as possible and anchored solidly to the tree.

Table 1. Shelter use by fox squirrels on 2 areas near Danville in late February, 1978. Fox squirrels were captured or shot in nest boxes and leaf nests; live-trapped squirrels were assumed to be using tree cavities after removal of boxes and leaf nests.



| Sex | Age | Number found in | | | | | |
|--------|-----------------------------|-----------------|--------|----------|----------------|-------------|--------|
| | | Leaf Nest | | Nest Box | | Tree Cavity | |
| | | Area A | Area B | Area A | Area B | Area A | Area B |
| Male | Subadult | 2 | 3 | Absent | 4 | 8 | 0 |
| | Yearling-adult | 8 | 5 | " | 20 | 13 | 14 |
| | Totals | 10 | 8 | | 24 | 21 | 14 |
| Female | Subadult | 1 | 0 | Absent | 1 | 4 | 3 |
| | Yearling-adult
anestrous | 3 | 1 | " | 2 | 0 | 3 |
| | Yearling-adult
estrous | 5 | 7 | " | 2 | 13 | 10 |
| | Totals | 9 | 8 | | 5 ^a | 17 | 16 |

^aTotal females significantly less ($P < 0.01$) abundant in nest boxes than males.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R.L. Westemeier,
J.E. Buhnerkempe

This spring prairie chickens were censused for the 20th consecutive year near Bogota in Jasper County, near Kinmundy in Marion County, and near Mt. Erie in Wayne County. The count near Hoyleton in Washington County was begun in 1969. These 4 areas were the only known sites in 1981 still harboring native remnants of the millions of pinnated grouse once distributed over at least two-thirds of Illinois.

Near Kinmundy, the prairie chicken population increased 32%, from 88 cocks in 1981 to 116 cocks this spring. Although sanctuary area near Kinmundy (146 ha [361 acres]) was less than near Bogota (405 ha [1,001 acres]), the distribution of booming grounds (leks) was more favorable for chickens. Leks extended from just south of Farina to just east of Brubaker--a distance of 14.4 km (9 mi). Chicken numbers were high on or near each of the 5 sanctuaries and the sex ratio appeared to be good. For example, the lek on the Illinois Natural History Survey Sanctuary showed a high count of 20 cocks and 23 hens on 4 April, a higher count of hens than for any lek at Bogota.

The Bogota flock increased 19%, from 70 cocks in 1981 to 83 cocks this spring. We had predicted 82.4 ± 15.0 cocks (MWRL 24(8):3) on the basis of the number of hatched nests found at Bogota in 1981. Considering recent cyclic highs

in Wisconsin and Minnesota and the current population increases in Marion County, it seems probable that the Bogota flock would be twice the present level if pheasants were not a strong adverse factor. The impact of pheasants on the prairie chickens at Bogota may be most serious during cyclic lows. The sex ratio at Bogota was 1.93 cocks per hen; the high count of hens for all leks was only 43 compared with 83 cocks. The distribution of leks at Bogota was less favorable than near Kinmundy. Ninety-five percent of the Bogota flock was concentrated on 3 central sanctuaries, with about 1.6 km (1 mi) on each side of a triangle connecting the leks. Such a concentration does not allow for the cover interspersed, edge effect, and opportunism available to the flock near Kinmundy.

Near Mt. Erie in Wayne County, 4 cocks were located this spring compared with 2 cocks in 1981. Near Hoyleton, however, no prairie chickens were found on either of the 2 prime mornings for locating chickens. Three cocks were located near Hoyleton in February 1981, but they were not found there during the seasonal peak of booming in 1981.

If one assumes a 50:50 sex ratio (probably not a valid assumption), Illinois has some 400 prairie chickens this spring, an increase of 25% since the spring of 1981.

Ecology and Management of White-tailed Deer - W-87-R

C.M. Nixon, L.P. Hansen
J.E. Chelsvig, P.A. Brewer

Evolution has provided white-tailed deer with a social system and life style designed to reduce predator losses and to enable deer to locate the successional landscapes that produce digestible forages. Man and his machines have substituted for the ancestral predators--wolf, mountain lion, bear--that shaped the white-tail as we know him today.

In central and northern Illinois, seasonal changes in availability of food and cover caused by planting and harvest have severely limited populations of pheasants, bobwhites, cottontail rabbits, and a host of nongame species. Yet these agricultural activities have not reduced the numbers of deer. Why not? Because the social system that evolved to succeed in prehistorical northern ecosystems works just as well to circumvent the drastic changes in landscape caused by agricultural activities. Harvest and fall plowing affect Illinois deer similarly as the northern winters affect deer farther north.

Deer in northern landscapes, where winters are often severe and the timber wolf still coexists, typically utilize distinct summer and winter landscapes, often many miles distant. Individual deer return consistently to the same summer range from the same winter range accompanied by their offspring. Young deer thus learn routes of migration by following the adults, and the patterns of dispersal are kept intact from generation to generation. Research has shown that the annual life cycle of deer is adapted to avoiding predation; deer live a generally solitary existence during the critical parturition and fawn-rearing period and

group together in fall and winter to spread predation risk throughout the group. The thermoregulatory needs of deer in severe winter weather also influence the choice of landscapes for group living.

Today in Illinois, the wolf is gone, few winters are severe, and digestible calories exist nearly everywhere. Yet the social patterns and movements shown by our marked sample of deer in Piatt County mimic those reported for northern deer. We are having difficulty following several generations of deer because of high predation by humans, but many of those we have managed to monitor throughout an annual cycle exhibit fidelity to summer and winter ranges. Perhaps because winter weather is relatively mild, not all deer migrate or disperse each year; females seem most likely to use the same landscape, either by remaining on the same range or by migrating. It is also possible that selection is beginning to favor those deer and their progeny who remain on secure refuges; they are more likely to produce offspring that survive to breed than those who disperse to small woodlots. We need more information to determine if all or most of the female young of those females who do not disperse also stay close to their mother's range. We have several mother-daughter groups marked and we will closely monitor their movement patterns in the coming months.

Cooperative Waterfowl Research - W-88-R

F.C. Bellrose, S.P. Havera,
G.A. Perkins, H.K. Archer

A natural resource inventory requires a classification system. A classification scheme most suitable for describing waterfowl habitat in Illinois would be a system (1) that can accurately describe the types of wetlands in Illinois, (2) that can group ecologically similar habitats so that value judgments may be made from collateral data on waterfowl populations, (3) whose concepts and terminology are broad enough to allow uniform comparisons with flyway and national habitat resource, and (4) whose products can be refined and updated.

Of the existing wetland classifications, only 2 are applicable for the entire country--that developed by Martin et al. (1953, USFWS Spec. Sci. Rep, Wildl. 20) and the recent system designed for the National Wetlands Inventory (Cowardin et al. 1979, FWS/OBS-79/31). Numerous regional classification systems for wetlands and deepwater habitats were reviewed but none fully satisfied our criteria.

The recently developed system by Cowardin et al. (1979) was found to be superior to that designed by Martin et al. (1953). The older system is a single-level classification composed of 20 types. The inherent lack of detail in this system has resulted in misclassifications and regional differences in wetland definitions. The newer system is hierarchical, thus allowing for systematic association and disassociation of large amounts of data. Data collection starts at the top of the hierarchy and proceeds downward with increasing detail depending on the resolution desired. If more detail is needed at a later date, the hierarchy can be continued without duplication of previous effort.

The structure of the new classification system progresses from systems and subsystems at the most general levels to more specific classes, subclasses, and dominance types. Special modifiers such as water-regimes and water chemistry can also be incorporated. Waterfowl habitat in Illinois will be classified entirely within 3 systems: Riverine, Lacustrine, and Palustrine--most will fall in the last 2.

The new system is not only more flexible and accurate than the older system, but its products can be more easily applied to legislative and regulatory actions. In particular, Section 404 of the Clean Water Act of 1977 as amended identifies categories of wetlands subject to regulatory programs and permit requirements. Other significant laws to which inventory data may be applied include the Fish and Wildlife Coordination Act of 1934 as amended, the Endangered Species Acts of 1966 and 1969, and the National Environmental Policy Act of 1969.

Next month we will discuss how some of our existing data may be used to classify wetlands under the new system.

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MONTHLY WILDLIFE RESEARCH LETTER

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Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Champaign, Illinois

May, 1982

Vol. 25, No. 5

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Last month (MWRL 25(4):1) we presented data regarding rates of observations for pheasants captured and backtagged on the Sibley Study Area (SSA) during the fall, 1962-65. Inferences were made concerning the importance of weight, molt characteristics, chronology of hatch, and age when captured relative to the survival of hens through at least 1 January. This month we will consider the importance of egress as indicated by these data.

The SSA is a 6 x 6-square-mile block. The capture location for each bird may be classified as being in the 4 (2 x 2) center sections, the 12 intermediate sections (surrounding the center), or the 20 perimeter sections. The location of capture was found to be the most important variable ($P < 0.001$) in the regression MANOVA analysis of factors influencing rates of observation.

Observation rates for hens captured and released in the center, intermediate, and perimeter sections of the SSA are compared in Table 1. For both juvenile and adult cohorts, observations declined from the center to the border of the SSA; no attempts were made to observe marked pheasants beyond the border. Although rates of observation were higher for adult hens (Table 1), observation rates declined similarly for both age cohorts from center to intermediate to perimeter sections.

As a minimal estimate of egress, we compared the numbers of backtagged pheasants observed in each of the 3 capture-release areas on the SSA (center, intermediate, and perimeter) with expected numbers if the observation rate for the entire study area was the same as for the center. In other words, we assumed that observation rates of 38.5% for juveniles and 59.3% for adults (Table 1) reflect what occurs without egress. Actual numbers of pheasants observed compared with numbers expected indicate that a minimum of 31% of the juvenile and 29% of the adult hens moved off the SSA during the observation period.

The ratios of marked to unmarked animals are commonly used as a basis for estimating the population levels on a given area. This method assumes that an insignificant number of marked individuals move off the area after capture. This assumption is apparently not plausible for pheasant populations on the SSA, particularly during fall and winter. Perhaps most interesting is the fact that rates of egress for juvenile and adult hens were nearly identical.

Table 1. Observation rates for hen pheasants captured on the center, intermediate, and perimeter portions of the SSA during the fall, 1962-65^a.

| Cohort | Capture Location | | |
|-------------------------|------------------|---------------------|------------------|
| | <u>Center</u> | <u>Intermediate</u> | <u>Perimeter</u> |
| Juvenile
(N - 1,443) | 38.5% | 29.9% | 21.4% |
| Adult
(N = 714) | 59.3% | 45.4% | 34.4% |

^aPheasants recorded as observed alive were seen at least once 1 January or later following capture.

Ecology and Management of Squirrels - W-66-R

C.M. Nixon,
L.P. Hansen

Gray and fox squirrels may be studied in the wild because of their diurnal activities. Such studies usually include capturing and marking squirrels for future visual observations. These studies indicate that a heirarchical social structure exists, with adult males, adult females, and young occurring in decreasing order of dominance. Little evidence of territoriality has been found, although it is commonly stated that a lactating female is territorial around her nest site. An indication that territoriality does not exist is the extensive overlapping of home ranges of fox squirrels.

In evaluating the seeming tranquility in tree squirrel populations, one might conclude (and several researchers have) that social behavior does not limit densities. Unfortunately, we know little about the role subtle, unobservable interactions play in density regulation. The low and constant densities of tree squirrels relative to the more cyclic rodents suggests some form of intrinsic density regulation.

Sensitivity analysis performed on data from our work with fox squirrels indicated that density changes are strongly affected by production and survival of young. Survival of young and reproductive rates were most strongly and negatively correlated with densities, leading us to hypothesize that intrinsic mechanisms, closely tuned to the density of squirrels, may regulate fox squirrel densities. A test of this hypothesis is important not only from the biological standpoint of furthering our understanding of the dynamics of fox squirrel populations, but for its management implications. If a population of fox squirrels is limited by social factors, an attempt to artificially increase densities beyond a point where survival and reproductive rates decline would be fruitless.

In future newsletters we will describe a field experiment designed to test the above hypothesis and the results of this experiment.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R.L. Westemeier,
J.E. Buhnerkempe

The concentrated distribution of the prairie chicken population at Bogota is a continuing concern in efforts to preserve Illinois' native prairie grouse (MWRL 25(4):3-4). Since 1970 when pheasants became common at Bogota, 71-92% of the prairie chicken cocks have been concentrated on the central 39% of the sanctuaries (MWRL 24(7):3), or about 5.1 km^2 (2 mi^2) of the overall range (sanctuaries and private land combined). Near Kinmundy in Marion County there are essentially no pheasants, and prairie chickens were found in good numbers this spring on and near each of the 5 sanctuaries. The chickens were dispersed from Farina to Brubaker, a lengthy range of about 14.4 km (9 mi).

For 6 consecutive years there have been no prairie chickens on the Mark Sanctuaries (23 ha, 57 acres) at Bogota, and this spring no chickens were found on the J. McCormack Sanctuary (32 ha, 80 acres). The McCormack tract was acquired in 1965 but the 1st prairie chicken cock was not present until 1972--a 7-year period to establish chickens on this tract. In the last years that chickens occupied the Mark and McCormack sanctuaries, their numbers were declining, and we noted pheasants acting aggressively toward chickens, parasitizing chicken nests, or nesting on each tract. The Mark and McCormack units are the smallest sanctuaries at Bogota and wooded areas make the habitat less than optimum. However, a similar area and distribution of woodland on 4 of the 5 sanctuaries in Marion County apparently has not limited use of the sanctuaries by chickens. On the 32-ha (80-acres) Perbix-Lacey II unit (acquired in 1977) near Farina, the count of chickens increased from 1 cock in 1979 to 21 cocks this spring--despite the relatively small size of the unit and the presence of mature hedgerows on 2 boundaries.

The good news at Bogota this spring was a 10-fold increase in chickens (1 cock in 1981 to 10 cocks in 1982) on the C. McCormick Sanctuary where our field headquarters are located. The McCormick tract was acquired in 1966 and the 1st chicken cock appeared in 1967. However, the count has averaged only 5 chicken cocks from 1967 through 1981. In addition to pressure from pheasants, the McCormick Sanctuary has long been subjected to (1) year-round disturbance by free-ranging dogs from 2-3 nearby farmsteads, and (2) relatively high predation on chicken nests. A 3rd adverse factor on the McCormick tract was the "hemming-in" effect by woody vegetation on 3 boundaries and in the center of the sanctuary. In October 1978, 0.8 km (0.5 mi) of woody fencerow was removed from the west boundary. In the summer of 1981, a grove of pines in 1 corner of the tract was removed, 7 large maple trees and several clumps of brush were removed from the center of the sanctuary, and all meadows were rotary mowed, hayed, or combined for grass seed (no rank undisturbed fields for roosting pheasants). The improved utilization by chickens on the C. McCormick Sanctuary may have been due to the lack of free-ranging dogs during the spring of 1982, or perhaps all factors combined. Thus, it appears that one means of

coping with the pheasant problem at Bogota (in addition to capture and removal) is to optimize the sanctuary habitat for prairie chickens and minimize other adverse factors (dogs and predators) to the extent feasible.

Errata by editors.

The 2nd sentence of the 2nd paragraph in last month's newsletter should have read: "Although sanctuary area near Kinmundy was 146 ha (361 acres) less than near Bogota (405 [1,001 acres]), the distribution of booming grounds (leks) was also more favorable for chickens."

Ecology and Management of White-tailed Deer--W-87-R C.M. Nixon, L.P. Hansen,
J.E. Chelsvig, P.A. Brewer

An aerial census of deer in Macon County was flown 4 February 1982; conditions were similar to those of previous surveys (MWRL 25(1):4). Although several small, scattered groups of deer were found, we observed only 1 major concentration-- 17 deer near the confluence of the Sangamon River and Friends Creek.

Allerton Park in Piatt County is a major winter-concentration area for deer in central Illinois. Winter helicopter censuses indicated a large increase in the number of deer in the Park from December to February (MWRL 25(3):3). Many of the deer that moved into the Park during winter presumably came from the eastern part of Macon County, which may account in part for the relatively small number of deer seen in Macon County.

We will examine this and other concentration areas in central Illinois more closely in the coming months. Regarding these properties, we will consider such factors as ownership, hunting status, human disturbance, and types of crops and forests to try to determine why they attract deer in winter. Information from these areas will be used to further define characteristics of concentration areas in other Illinois counties.

Cooperative Waterfowl Research - W-88-R

F.C. Bellrose, S.P. Havera,
G.A. Perkins, H.K. Archer

In selecting a wetland classification system for describing waterfowl habitat in Illinois, we looked for a system applicable to wetland data in our files, particularly our extensive data on the surface area (at 15-cm [6-in] contour intervals) of a representative sample of bottomland lakes in the Illinois River valley. The U.S. Fish and Wildlife Service (USFWS) system that we selected (Classification of Wetlands and Deepwater Habitats of the U.S., 1979) employs the area concept of classification. For example, a lake or marsh would not generally be classified as a single entity but would be subdivided into relatively homogeneous units, such as aquatic beds or emergent wetlands. The USFWS system was designed to collect data by high-altitude aerial photography.

Wetland units are outlined and measured on the photographs and then delineated by classes and subclasses (based on life forms of vegetation) and dominance types (based on dominant plant species).

We will modify this method somewhat in our classification of the bottomland lakes in the Illinois River valley; due to the physical characteristics of these lakes, aerial photographs will not be necessary. Sedimentation in these lakes since the turn of the century has changed their bottom profiles into platter-shaped basins and eliminated all but a few scattered beds of aquatic vegetation. At normal water levels, the present average depth of bottomland lakes is only 0.6 m (2.0 ft). When water levels are at the wooded shorelines, it takes little reduction in water levels to expose large areas of the lake basins as mud flats. Because of the nearly uniform characteristics of the bottomland lakes, we can use available data on surface areas at different contour intervals for wetland classification. By systematically sampling selected areas of mud flats and integrating the results with data in our files, we can determine with reasonable accuracy the composition and extent of moist-soil plant communities under given environmental conditions. This method may not be as accurate as measuring all wetland units on aerial photographs. However, a one-time measurement of a dynamic system is only accurate for a specific time under existing circumstances. Our approach will allow the classification of the Illinois Valley wetlands under "average" conditions and will provide more useful information under varying conditions than would the use of aerial photographs.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

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Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Approximately 90% of the farmland in east-central Illinois has been used to produce corn and soybeans since the mid-1970's, thus limiting the land available for pheasant habitat. We have been attempting to evaluate the management of roadsides as a means of enhancing pheasant populations under intensive land-use conditions. Unfortunately, since 1976 the reproduction and survival of pheasants in east-central Illinois have been hampered by periods of abnormal weather.

Following severe winter storms in 1976-77 and 1977-78, pheasant numbers declined dramatically, but pheasants on the Sibley Study Area (SSA) and Ford County Management Unit (FCMU) began to recover by 1980 (Table 1). However, a severe drought during the brood-rearing season in 1980 apparently negatively

Table 1. Cock pheasants observed per 100 miles of driving along standard routes on the FCMU and SSA in April and May, 1976-82.

| <u>Year</u> | <u>SSA</u> | <u>FCMU</u> |
|-------------|------------|-------------|
| 1976 | 117.4 | 123.3 |
| 1977 | 22.8 | 30.8 |
| 1978 | 6.4 | 6.9 |
| 1979 | 5.3 | 10.8 |
| 1980 | 16.5 | 23.1 |
| 1981 | 6.6 | 37.5 |
| 1982 | 5.0 | 10.8 |

affected the survival of juvenile pheasants. Last summer (1981) several heavy rains and flash floods occurred in east-central Illinois during the late nesting and early brood-rearing period. Despite the 1980 drought and 1981 rains, spring breeding densities of pheasants continued to increase on the FCMU (Table 1).

The spring census data for 1982 (Table 1) reflect the effects of the winter of 1981-82. Although winter storms in 1981-82 were not as severe as those in 1977 and 1978, the prolonged snow cover and cold apparently caused declines in the 1982 breeding populations on the SSA and FCMU (Table 1). Spring breeding populations of pheasants on 3 other study areas in east-central Illinois showed similar declines.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

In last month's newsletter we hypothesized that intrinsic mechanisms closely tuned to the density of squirrels regulate fox squirrel densities. To test this hypothesis we designed a field experiment using 7 separate oak-hickory dominated plots. During fall 1979, we livetrapped and removed (1) all captured males from 2 plots (Allerton B and Busch), (2) all captured females from 2 plots (Allerton A and C), and (3) all captured fox squirrels from 1 plot (Allerton D). For controls, we monitored 2 woodlots (Trelease and Brownfield) from which fox squirrels had not been removed.

Fox squirrels captured elsewhere were released on all of the experimental and control plots in fall 1979 to serve as introduced "immigrants." Each study plot was retrapped without removal during spring 1980 to determine recapture and reproductive rates of resident and introduced squirrels and the rates of recruitment of new squirrels. Regardless of prior removals, few of the released squirrels were recaptured on the same plots where they were released. Therefore, we discontinued attempts to artificially introduce immigrants onto the study plots. We also ceased using Trelease and Brownfield woodlots as controls because the structure and composition of plant species on these plots differed markedly from the experimental plots.

An additional grid (Allerton E) was set up as a control during fall 1980. Removal during the fall and retrapping during the spring occurred during 1980-81 and 1981-82 as in 1979-80 except that only the adult segment of the population was removed. In next month's newsletter we will begin discussion of some of the results of this experiment.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R

R.L. Westemeier,
J.E. Buhnerkempe

Included in the annual census of prairie chickens this spring, as in 1981, was a census of pheasants on the Bogota Study Area; standard census methods were used. As in the past 19 years, a block of some 32 mi² (81.9 km²) that included the prairie chicken sanctuaries near Bogota was surveyed beginning about 1 April, primarily to locate booming prairie chickens. The survey was extended into early May, the peak crowing season for pheasants, in 1981 and 1982. A special effort was made to triangulate each crowing cock pheasant on the sanctuaries by making frequent listening stops and by listening for 4 minutes instead of the standard 2 minutes at each stop.

We estimated 46 crowing cock pheasants on the 32-section block this spring (30 cocks on or very near the sanctuaries and 16 cocks away from the sanctuaries on private lands), which is essentially the same population level and distribution of pheasants as in spring 1981 (MWRL 25(2):2-3). Comparative densities of pheasant cocks are 18.8 per mi² (2.6 km²) for the 1.6 mi² (4.1 km²) of sanctuaries and 0.5 per mi² for 30.4 mi² (77.8 km²) of private land. The pheasants at Bogota continue to be essentially a local population that is strongly dependent upon sanctuary habitat.

Two to 8 pheasant cocks crowed consistently on each of the 7 sanctuaries at Bogota. Since pheasants became common at Bogota, prairie chickens have disappeared from 2 sanctuary units and are barely "hanging on" on 2 other units. This spring 95% of the chickens were concentrated on 3 central sanctuaries.

Fortunately, no pheasants were seen or heard on or near the sanctuaries in Marion County during booming ground surveys in early April. Thus, we felt little need to rerun the listening-stop route in Marion County in early May. A large landscape of about 36 mi² (89 km²) that surrounds the sanctuaries near Kinmundy and Farina has also been routinely surveyed each spring since 1963.

Ecology and Management of White-tailed Deer - W-87-R C.M. Nixon, L.P. Hansen,
J.E. Chelsvig, P.A. Brewer

During the 1st 2 years of this study, we captured and marked 37 fawns and have been able to monitor the dispersal movements of 28 of them. Of these 28 fawns, 21 (72.5%) are known to have moved from their capture areas.

Why deer disperse from winter concentration areas is unknown, but one possible cause considered by other researchers is that the behavior of the mother influences the movements of the fawns. Of the 28 deer that we observed, 9 were orphans, 12 were non-orphans, and for 7 it was unknown if they were orphans or non-orphans. Five of the orphans (56%) and 10 of the non-orphans (83%) are known to have left the study area. A greater proportion of the non-orphans moved than the orphans but the difference is not significant ($\chi^2_1 = 1.944$, $P > 0.10$). Six of the "unknown" fawns moved. As most of these fawns were probably non-orphans, future sampling may show a significant difference between orphans and non-orphans in the tendency to move.

Most of the non-orphans that moved (70%) moved with the mother, and each of these moved again on its own--at least far enough to be separated from its mother. Emotional attachment to the mother influences the dispersal of fawns, but probably another important factor is maternal aggression just before fawning.

Cooperative Waterfowl Research - W-88-R F.C. Bellrose, S.P. Havera,
G.A. Perkins, H.K. Archer

By early March 1982, numbers of ducks in Illinois were already on the increase when Robert Crompton made the 1st spring aerial-census flight. In late March, duck numbers peaked at 347,335 in the Illinois Valley (70% of the peak for the fall of 1981) and 185,225 in the Mississippi Valley (22% of fall 1981 peak). These numbers were considerably higher than the 1981 spring peak for the Illinois Valley, which was 206,600 ducks (40% of fall 1980 peak) and considerably lower than the 1981 spring peak for the Mississippi Valley, which was 396,000 ducks (42% of fall 1980 peak).

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Peak numbers of 117,000 Canada geese, approximately 3,000 of which were the giant race, and 7,400 snow geese were present in the Illinois Valley during March of 1982. The Mississippi Valley hosted peak numbers of 20,300 Canada geese and 3,900 snow geese. The Canada goose peaks for the spring migration were 3 to 4 times the abnormally low numbers for the previous spring of 1981, but had not yet rebounded to the peak levels for the 1980 spring migration.

Waterfowl stay in Illinois for a shorter time during spring migration than during fall migration. Goose concentrations decreased abruptly by mid-March of 1982, and duck numbers were declining by mid-April. Common goldeneyes and common mergansers, which overwinter in Illinois, are the 1st species to depart for the northern breeding grounds. Geese are also early migrants, followed by such dabblers as pintails, mallards, black ducks, and wigeon, some of which spend the milder winters in Illinois. The majority of the diving ducks arrive about midway during the migration season; canvasbacks and redheads are the 1st to appear and scaup and ruddy ducks are the last to leave. The latest spring migrants are blue- and green-winged teal and northern shovelers.

Many factors cause the timing and duration of the spring migration to vary from year to year: inconsistent spring weather (probably the most important factor), water levels and food conditions (which are partially dependent upon weather), and the physiological readiness of the birds to migrate.

The unusually harsh winter and spring in Illinois in 1981-82 delayed the spring migration 2-3 weeks in comparison with the mild winter and spring of 1980-81. After the onset of 1982's spring migration, high water levels during March and April and poor food conditions (MWRL 24(11):4) encouraged a rapid migration through Illinois. Water conditions on the breeding grounds in the prairie pothole region are generally more favorable than last year.

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Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

As the Roadsides For Wildlife (RFW) program has expanded in recent years, the acceptance of the program by farmers appears similar to the acceptance and spread of commercial farm innovations. The 1st farmers who comply with the RFW program apparently influence the spread of roadside management to other farmers in the area. These 1st participants, however, are not necessarily those who will participate for a long term or communicate positive attitudes regarding the program. Therefore, when the program is first introduced in an area, the Department of Conservation should be able to identify those farmers who will most likely be "model participants" in the RFW program.

Research on the Ford County Management Unit (FCMU) indicates that individuals having these characteristics are most likely to participate for a long term: (1) hunts on his farm at least occasionally, (2) is 45 or less years of age, (3) farms 400 acres or less, (4) has at least the average number of contacts with the county farm advisor, and (5) participates in at least 1 other government agricultural program. Individuals possessing these characteristics could probably be identified by county farm extension advisors.

The more farmers who participate in the RFW program the better; therefore, preference is not given to any particular type of farmer. However, if those individuals who will most likely participate for a long term are first accommodated, their influence may enhance overall levels of compliance in the RFW program for that area.

Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

If individuals from a particular sex-age segment of a fox squirrel population affect demographic parameters, such as reproduction, survival, and recruitment, removal of that segment of the population should cause change in those parameters. As discussed in previous newsletters, we measured reproductive, survival, and recruitment rates of fox squirrel populations from which different sex-age segments had been removed. Reproductive rates (% lactating) tended to be similar during the fall on the experimental plots and higher on the experimental plots than on the control plots (Table 1); however, the differences were not significant ($P > 0.50$). We also found that yearlings bred at a higher rate on the experimental plots than on the control plots, although sample sizes were low (Table 1).

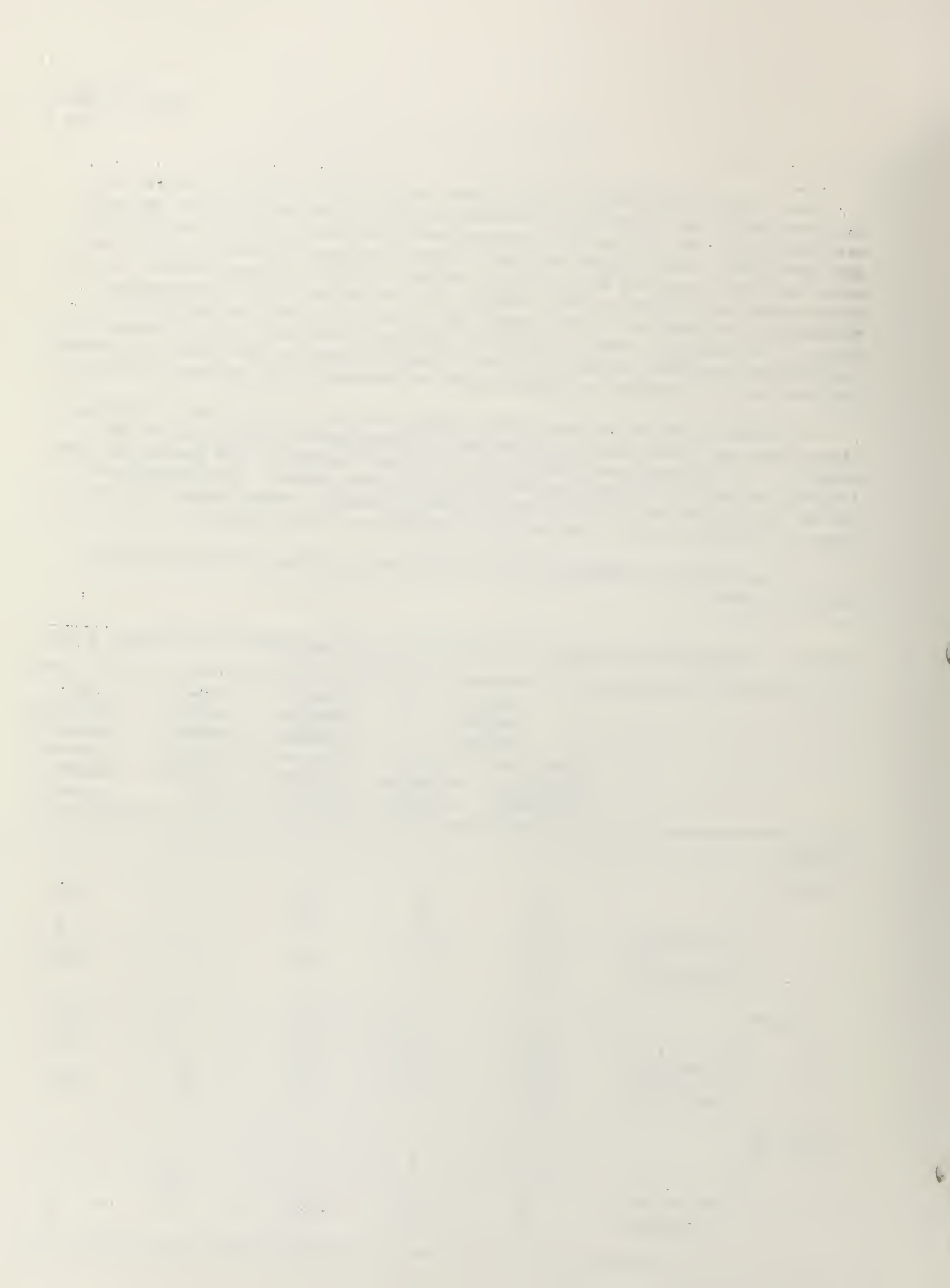
One of the male-removal plots (Busch) was the only site not located in Allerton Park. During fall 1981 and spring 1982, reproductive rates on Busch were extremely low (11% and 17%, respectively), unlike those for squirrels on the Park plots. Adult males had been intensely cropped on Busch and few adult males had been recruited during these periods. While it seems unlikely, we may have removed so many males that females were not being bred, or some other phenomenon unrelated to the experiment may have caused the low reproductive rates. For whatever reason, the desired test of the effect of male removal on reproduction probably was not realized. When the results from Busch are dropped, fall and spring reproductive rates on the male-removal plot increase (Table 1).

Although reproductive rates among plots were not significantly different, these rates were consistently higher on the experimental plots than on the control. It is not clear, however, which if any segment of the population most strongly affected density. Reproductive rates are probably determined by a myriad of interacting intrinsic and extrinsic factors, one of which involves in some way the densities of sex and age components of the population.

In next month's newsletter we will discuss the effect of the removal on survival rates.

Table 1. Reproductive rates of fox squirrels on experimental and control plots.

| | Adult males removed | | Adult females removed | All adults removed | No squirrels removed |
|------------------|---------------------|------------------|-----------------------|--------------------|----------------------|
| | Allerton B & Busch | Allerton B alone | Allerton A & C | Allerton D | Control plots |
| Adults | | | | | |
| Fall | | | | | |
| N | 25 | 16 | 15 | 3 | 12 |
| # lactating | 12 | 11 | 7 | 1 | 3 |
| % lactating | 48 | 69 | 47 | 33 | 25 |
| Spring | | | | | |
| N | 79 | 34 | 16 | 8 | 23 |
| # lactating | 50 | 24 | 13 | 6 | 15 |
| % lactating | 63 | 71 | 81 | 75 | 65 |
| Yearlings | | | | | |
| N | 10 | 4 | 9 | 1 | 3 |
| # lactating | 4 | 2 | 5 | 0 | 0 |
| % lactating | 40 | 50 | 56 | 0 | 0 |



Responses of Prairie Chickens to Habitat Manipulation - W-66-R R.L. Westemeier,
J.E. Buhnerkempe

In recent newsletters we discussed responses by nesting prairie chickens and pheasants to (1) warm-season native prairie grasses in comparison to cool-season introduced grasses and legumes (MWRL 24(12):2-3) and (2) various means of managing prairie grasses (MWRL 25(1):3-4). In this report we examine nest densities by birds and mammals in prairie grass according to a combination of prescribed burning and other management approaches. Nest densities are expressed as nests per 4 ha because 10 acres (4 ha) is the average field size on the prairie chicken sanctuaries. The data are for a cumulative total of 656 acres (265 ha) of prairie grass searched for nests from 1967 through 1981 at Bogota. Prairie chickens (52 nests) were the 3rd most abundant nesting bird in prairie grass.

Unburned prairie grasses averaged 11.0 nests per 4 ha for the 13 avian species found nesting in fields dominated by prairie grasses on the sanctuaries. There were no significant differences ($P > 0.05$) in nest densities for avian nesters, collectively, or for prairie chickens or dickcissels among undisturbed, high-mowed (by rotary mower or combine), or hayed prairie grasses that had not been burned. Prairie chickens averaged 0.4 to 0.5 nest per 4 ha among the 3 categories. Quail, cottontails, and small mammals averaged 0.9, 0.8, and 58.3 nests per 4 ha, respectively, but these species showed significantly ($P < 0.05$) higher densities in the undisturbed type than in mowed or hayed prairie grasses that had not been burned.

During the 1st nest season following a prescribed burn (recent burn) of prairie grass, we found a total avian nest density of 9.2 nests per 4 ha. No nests were found for prairie chickens, pheasants, mallards, woodcocks, field sparrows, or Henslow's sparrows in recently burned prairie grass; however, nest densities per 4 ha for other species were: small mammals, 21.7; redwings, 7.5; dickcissels, 0.6; meadowlarks, 0.5; quail, 0.3; and 0.1 each for mourning doves, grasshopper sparrows, short-billed marsh wrens, and cottontails. One upland sandpiper nest was found accidentally in a prairie grass field that had recently been burned.

During the 2nd, 3rd, 4th, and 5th or later nest seasons following prescribed burning, the means for total avian nest densities per 4 ha were 25.9, 24.9, 30.2, and 10.4, respectively. The means for rotary-mowed prairie grass were particularly high--33.7 and 67.4 nests per 4 ha for the 2nd and 3rd nest season, respectively, following a burn. Nest densities for prairie chickens were also high in high-mowed prairie grass during the 2nd (1.9) and 3rd (1.8) nest season, but, curiously, they were highest by the 5th or later (5.1) nest seasons following burning--again in the high-mowed type. No particular preferences for post-burns or management type were noted for pheasants from the limited sample of 19 nests. Redwing nest densities followed a pattern similar to the pattern for avian densities as a group, probably because redwing nests (693) comprised 72% of the total sample (964) of the bird nests found in prairie grasses. Dickcissels, the 2nd most abundant nesting bird (91 nests), showed a peak nest density the 3rd nest season following a burn (2.4 per 4 ha), as did cottontails (1.7) and small mammals (40.0).

We noted that by the 5th or later nest season following burning, nest densities for avian nesters overall had returned to densities similar to that in unburned or recently burned prairie grass. Our data for prairie grass management suggest that a combination of prescribed burning at intervals of 3-5 years and high mowing is beneficial to prairie chickens and to a variety of grassland nesters. However, we need to evaluate limited grazing as a substitute for rotary mowing because of the constraints imposed by energy conservation and economics. Haying of prairie grasses may have merit but probably at intervals not more frequent than 3 years.

Ecology and Management of White-tailed Deer - W-87-R

C.M. Nixon, L.P. Hansen,
J.E. Chelsvig, P.A. Brewer

Many studies of male deer dispersal have found that males, particularly yearlings, tend to disperse in the fall when social pressure from breeding activity is greatest. It was concluded that this pressure is the stimulus that causes the males to disperse.

Observations during the present study show that bucks disperse in the spring when there is no breeding activity. The stimulus for spring dispersal is uncertain, but in the case of male fawns, dispersal may be triggered by the mother's aggressive behavior while trying to isolate herself for fawning.

Hormonal changes in the bucks may also provide a dispersal stimulus. Other researchers have found slight increases in serum androgen levels in male deer during April and May that coincide with the onset of antler development. According to our observations, these months are also the time of spring dispersals.

Although aggressive behavior and hormonal changes may not be the reasons that male deer disperse from apparently suitable habitat into unfamiliar areas, these factors seem to be important in determining the time at which the movement occurs.

Cooperative Waterfowl Research - W-88-R

F.C. Bellrose, S.P. Havera,
G.A. Perkins, H.K. Archer

The aerial waterfowl censuses, conducted each fall and spring by Robert Crompton, provide an opportunity to monitor population changes of endangered bald eagles while they overwinter in Illinois. Because the eagles feed primarily on fish, they concentrate along the Illinois and Mississippi rivers. The eagles are often difficult to see when perched in trees, but Crompton believes that he censuses approximately 75% of them.

In 1981, eagles began moving into Illinois from their northern breeding grounds during late September--1 month earlier than in 1980. Eagle numbers in the Illinois River valley between Spring Valley and Grafton reached a peak of 223 birds during the 1st week of March. This compares with peaks of 166, 240, 361, and 265 birds for the winters of 1976-77, 1977-78, 1978-79, and 1980-81,

1890

The first of the year was a very dry one, and the crops were much injured. The weather was very hot, and the crops were much injured. The weather was very hot, and the crops were much injured.

The second of the year was a very wet one, and the crops were much injured. The weather was very cold, and the crops were much injured. The weather was very cold, and the crops were much injured.

The third of the year was a very dry one, and the crops were much injured. The weather was very hot, and the crops were much injured. The weather was very hot, and the crops were much injured.

The fourth of the year was a very wet one, and the crops were much injured. The weather was very cold, and the crops were much injured. The weather was very cold, and the crops were much injured.

The fifth of the year was a very dry one, and the crops were much injured. The weather was very hot, and the crops were much injured. The weather was very hot, and the crops were much injured.

The sixth of the year was a very wet one, and the crops were much injured. The weather was very cold, and the crops were much injured. The weather was very cold, and the crops were much injured.

respectively. The Seneca-Spring Valley segment hosted 44 additional eagles in 1981. Areas of eagle concentration in the Illinois Valley included Plum Island below Starved Rock Lock and Dam, Goose Pond (Putnam County), Meyer's Ditch near Lake Chautauqua, Grand Island near Bath, the Sangamon River mouth area, and the Six-mile Island area of Swan Lake.

In the Mississippi River valley, bald eagles increased gradually until late December 1981 when their numbers reached the following peaks: 262 birds from Moline to Alton during the 1st week of March, 197 birds from Dubuque to Moline in February, and 135 birds from St. Louis to Cairo in January. Major concentrations of the birds occurred below dams, particularly the Oquawka and Keokuk dams, where the water remained open for fishing during cold weather. Many birds were also observed in the vicinity of the Keithsburg, Louisa, Batchtown, and Shanks refuges and the Chester-Cairo area. A few individuals of the 1981-82 winter population also dispersed to cooling lakes and reservoirs throughout the state at an average density of 2 eagles per lake. Strip mine lakes in Fulton and Knox counties hosted additional individuals with a peak of 14 birds in early January.

Immature bald eagles 1-4 years of age can readily be identified by their mottled brown plumage, which contrasts greatly with the adult's conspicuous white head and tail. Approximately 35% of all eagles observed during the winter of 1981-82 were immatures as compared with 30% for the winters of 1976 through 1978. The actual percentage of immature eagles in the population is probably higher because the dull-colored immatures are more easily overlooked than adults when perched in shoreline trees.

In early March this spring, the bald eagles began leaving for their breeding grounds. The exodus was completed rather abruptly by the last week of March.

MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Champaign, Illinois

August, 1982

Vol. 25, No. 8

Manipulation of Pheasant Habitat - W-66-R

R. E. Warner

Radiotelemetry data were recently analyzed for 5 pheasant hens with broods that hatched on managed roadsides on the Ford County Management Unit (FCMU). Use-of-habitat and movement data for these broods are unique because the pheasants hatched in nests 0.5 mile or farther from traditional foraging habitat (oats/hay)--a common phenomenon in recent years. The radiotelemetry data for the FCMU broods in 1975-81 may be compared with data for broods monitored on the Sibley Study Area (SSA) in 1972-73 whose nest sites were near fields of hay and oats; these grains were more common in that era.

Use of cover by radio-monitored pheasant broods on the SSA and FCMU is summarized in Table 1. In the absence of hay and oats, broods on the FCMU (compared with the SSA) were located more frequently in corn and, to some extent, edge and strip cover (Table 1). The use of cover by broods on the FCMU, compared with the SSA, suggests the following:

1. The increased use of corn was primarily for roosting and loafing activities.
2. The slight increase in use of edge/strip cover was for increased travel.
3. Broods hatching on roadsides tended to avoid the nest site and generally used roadsides only to travel to other cover types. These broods rarely used road edges for early morning drying activities.
4. Wheat is not as attractive to broods as oats or hay-oats; broods near wheat were located at the interfaces of wheat and other cover types but generally spent little time in the wheat.

Table 1. Use of cover by radio-monitored hen pheasants with broods near traditional brood foraging habitat (SSA, 1972-73), and for broods hatched on seeded roadsides 0.5 mile or farther from traditional brood foraging habitat (FCMU, 1975-81.^a

| Area | Number of Radio Locations | | | | |
|---------------------|---------------------------|----------|-----------------------------------|-----------|----------------|
| | Corn | Soybeans | Hay/
Small Grains ^b | Roadsides | Edge/
Strip |
| SSA | 69 | 75 | 188 | 51 | 50 |
| (8 broods, N = 433) | (16%) | (17%) | (43%) | (12%) | (12%) |
| FCMU | 307 | 72 | 15 | 57 | 116 |
| (5 broods, N = 567) | (54%) | (13%) | (3%) | (10%) | (20%) |

^aData are for the 1st 12 weeks of life.

^bRadio locations were in hay and oats on the SSA and in wheat on the FCMU.



Ecology and Management of Squirrels - W-66-R

C. M. Nixon,
L. P. Hansen

We anticipated that removal of adult squirrels would cause increased survival of the remaining young and adults on our study sites. Recapture rates of adult males and females were consistently higher on the MRP (male removal plot) and control than on the FRP (female removal plot) and TRP (total removal plot). This indicates that adult males may negatively impact densities by affecting survival. Two observations, however, suggest that this may not be true. Recapture rates were similar on the MRP and the control, and neither differed greatly from those reported from unmanipulated fox squirrel populations in other studies.

We observed low recapture rates of adults on the TRP, from which adult males had been removed, and unusually low recapture rates on the FRP and TRP. These observations suggest that adult survival rates may have been depressed where females were removed rather than enhanced where males were removed. Depressed recapture rates of adults could have resulted because most adult females captured on the plots from which adult females had been removed were immigrants. These females may have been less likely to remain or survive on an area than were residents, even in the absence of adult resident females. Low recovery rates of adult males on the FRP may have resulted from increased competition for the low numbers of estrous females, possibly resulting in increased movement off of the study plot.

Yearling male and female survival, although seemingly positively affected by female removal, was not consistently influenced by any treatment. We observed differences among plots, but inconsistencies in replicate samples suggested the differences were related to some factor other than treatment. Juvenile-subadult (J-SA) male survival did not differ among treatments, whereas J-SA female recovery rates were lowest on the FRP and TRP and highest on the control. This suggests there was a positive effect of adult females on survival of young females. As with adult females, however, this may again relate to characteristics of the young rather than to the absence or presence of the adult female. Most of the young females captured on the FRP were immigrants. The young females captured on the control and MRP may have been individuals born on the area that did not disperse. Differences in recovery rates might be expected between these 2 groups. These results suggest that recovery rates may have been affected by removal of adults, but indirectly--by changing the characteristics of the group of animals on which survival was being measured.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R

R.L. Westemeier,
J.E. Buhnerkempe

Last month we discussed nest establishment rates for birds and mammals in prairie grass according to a combination of prescribed burning and other management. In this report we look at nest success for 3 galliform birds in prairie grass.

Due to limited sample sizes of hatched nests for prairie chickens, pheasants, and quail in prairie grass, we could not show significant $P > 0.05$) differences for nest success relative to burning or other management conducted prior to nest seasons. The highest density of hatched prairie chicken nests was associated with post-burn $\geq V$ (5th or later nest season since fire) and high mowing. Highest

densities of hatched quail nests were found in the unburned and post-burn II categories that were either undisturbed or high mowed the year prior to nesting. For pheasants, our data were far too limited to make even a judgment about prairie management and nest success.

Nest success by the 3 Galliformes was also considered in relation to the degree of nest concealment by prairie grasses. These data were mostly for nests in fields dominated by prairie grass, but the data also included nests in fields not dominated by prairie grass but which had prairie grass at the nest sites. For prairie chickens (sample of 90 nests), nest success decreased significantly ($P < 0.05$) as the quantity of prairie grasses concealing the nests increased; success ranged from 68.3% with vegetation other than prairie grass to only 14.3% when nests were fully concealed by prairie grasses. For pheasants (sample of 18 nests), nest success ranged from 33.3% with vegetation other than prairie grass to 50.0% when nests were fully concealed by prairie grass. These data suggest that the amount of prairie grass at nest sites influenced the probability of hatching differently for pheasants than it had for prairie chickens. For 38 bobwhite nests, hatch success was relatively high regardless of the quantity of prairie grass at the nest site but phenomenally high, 85.7%, for 14 nests that had no prairie grass at the nest sites. Here again, perhaps the association of nests with clumps of prairie grasses reduced the probability of hatching. The data for pheasants and quail, however, were not statistically significant ($P > 0.05$).

Predators evidently key on vegetative clumps in April and May in their search for avian prey--often the eggs and young of redwings and dickcissels. These birds typically nest in such clumps, particularly in post burns II, III, and IV. Thus, nests of prairie chickens, and perhaps bobwhites, that are found in vegetative clumps have a higher risk of predation. Rotary mowing or combining imparts a more uniform structure to stands of prairie grass, which in some manner enhances nest densities and success for prairie chickens. Predators apparently have more difficulty finding chicken nests in relatively uniform mowed stands than in undisturbed or hayed stands, particularly by the 5th or later nest season after burning when redwing nesting is minimal. Redwings and dickcissels are probably the primary attractants of predators to post burns II-IV.

Ecology and Management of White-tailed Deer--W-87-R

C.M. Nixon, L.P. Hansen,
J.E. Chelsvig, P.A. Brewer

The last 2 reports (MWRL 25(6):3; 25(7):4) have dealt with the dispersal of adult bucks and orphan and non-orphan fawns. This report focuses on adult and yearling females.

The primary time of dispersal for female deer (as for male) is spring--mostly during April and May. The does are subject to the same environmental conditions as other deer but they are also subject to the effects of pregnancy. Production of placental hormones changes as the fetus(es) develops. Researchers in New York found that plasma estrogen levels remained constant from January through March but increased substantially during April and again during May. These increases coincide with dispersal times for deer in east-central Illinois. It is believed that the increase in estrogen during the final 2 months of gestation may be partly responsible for triggering spring dispersals.

Not enough information is available yet to determine precisely which factors stimulate spring movements. Hormone changes related to pregnancy and antler growth are probably involved, but vegetation phenology and hormonal responses to increasing photoperiod may also be important. Aggressive behavior, particularly between does and their yearling offspring, may also have a strong influence on whether or not an individual deer disperses.

Cooperative Waterfowl Research - W-88-R

F.C. Bellrose, S.P. Havera,
G.A. Perkins, H.K. Archer

Waterfowl hunting has historically been a popular sport in Illinois. Through the years the sport has been affected by changes in wetland habitat and game laws and by decreasing numbers of waterfowl. A 1939 hunter questionnaire from the Havana Lab files revealed some interesting information about hunting styles in that era.

The 125 hunters that were questioned averaged 44 years of age (range: 25-76) and had been duck hunting for an average of 21 years (range: 1-65 years). When asked what types of shooting they did, 55% mentioned marsh shooting; 31%, river; 13%, dry-land; 4%, pond; and less than 2% for each category of lake, creek, slough, and timber. Seventy percent of the hunters used decoys to attract ducks and 15% were assisted by professional "pushers" or guides who rowed or poled boats for hunting. Sixteen percent pass shot flying ducks and 14% jump shot ducks as they flushed from bodies of water.

The favorite brands of shotguns of the hunters questioned were Winchester, 38%; Remington, 32%; and Browning, 15%. Other brands reported included L. C. Smith, Savage, LeFever, Springfield, Stevens, Ithaca, Colt, Parker, and Ranger. The majority (43%) preferred double-barreled shotguns. Most chose 12 gauges. Sportsmen questioned used from 4 shells to 2 cases of shells (1,000) during the entire 1939 hunting season, which extended from 22 October to 5 December. That season compared in length to our current 50-day season, although Illinois now has 3 hunting zones with varied season dates. They reported killing from 1 to 515 ducks per man during the 1939 season for an average of 40 ducks per hunter. The daily limit in 1939 was 10 ducks, with no wood ducks and 3 canvasbacks allowed; today the 100-point system is used. Two dozen hunters reported shooting geese, coots, and snipe with an average kill per hunter of 9 geese, 11 coots, and 15 snipe.

According to the questionnaire, dogs were not widely used for duck hunting in 1939. Only 14% of the hunters mentioned dogs when questioned about their hunting methods. Spaniels of the American, springer, water, and cocker varieties were the most popular hunting dogs (62% of those reporting), followed by Irish setters (25%) and Labrador retrievers (20%). In recent years, the Labrador retriever has increased in favor with duck hunters.

Even though the art of waterfowling has changed considerably over the past 40 years, the enthusiasm of the hunters has not.

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MONTHLY WILDLIFE RESEARCH LETTER

Illinois Federal Aid Projects W-66-R, W-87-R, and W-88-R

Department of Conservation and Natural History Survey, Cooperating

Glen C. Sanderson and Eva Steger, Editors

Champaign, Illinois

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Manipulation of Pheasant Habitat - W-66-R

R.E. Warner

Pheasant census data for spring and summer 1982 are summarized in Table 1 for the Sibley Study Area (SSA), Ford County Management Unit (FCMU), and Anchor, Prairie Green, and Harwood areas. Personnel from the Department of Conservation (Project W-85-D) assisted with the censuses.

The average density of breeding cocks in May (Table 1) was the lowest recorded since all 5 areas have been simultaneously censused, beginning in 1976. The magnitude of declines registered by both the May and August counts tended to increase from west to east. For example, the decline in numbers of pheasants was greater in the Harwood and Prairie Green areas, located in Champaign and Iroquois counties respectively, than in areas located to the west in Ford and McLean counties. On the SSA and Anchor areas, brood counts were relatively unchanged from 1981 (Table 1).

Table 1. The average number of cock calls per 2-minute stop (May) and broods observed per 100 miles along transect routes (August) on 5 study areas in east-central Illinois, 1982.

| | May Cock Calls | | August Broods | |
|---------------|--|----------------|--------------------|-----------------------------|
| | Calls/stop
($\bar{x}$) ^a | Decline
(%) | Broods/
100 mi. | Decline
(%) ^b |
| SSA | 1.4 | 26 | 1.8 | 6 |
| FCMU | 3.6 | 50 | 2.5 | 33 |
| Anchor | 1.5 | 52 | 3.9 | 3 |
| Prairie Green | 4.6 | 43 | 2.5 | 34 |
| Harwood | 4.4 | 44 | 0.6 | 89 |
| $\bar{x}$ | 3.1 | 43 | 2.3 | 33 |

^aThe average of the 5 highest counts per station, for 9 different cock call stations.

^bPercent decline from 1981 for the same census.

The winter of 1981-82 was one of the most severe on record in Illinois. However, the effects of severe weather during the cold season of 1981-82 appear to be more localized than those of the statewide winter storms in 1976-77 and 1977-78 that decimated pheasant populations. The Illinois Cooperative Crop Reporting Service reported near-normal temperature and precipitation for counties in the West Crop-Reporting District during the 1981-82 cold season. However, weather data for the West, Central, and East crop-reporting districts indicate that winter temperature and precipitation patterns became more severe from west to east. Hence, winter weather patterns during 1981-82 appear to correspond with the relative declines noted for pheasants in central Illinois (Table 1).

Ecology and Management of Squirrels - W-66-R

C.M. Nixon,
L.P. Hansen

If adult fox squirrels are intolerant of other fox squirrels, especially those of the opposite sex, we would expect higher immigration rates where adults have been removed than where adult densities are intact. As described in a previous newsletter (MWRL 25(8):2), we manipulated adult densities on 5 study plots and maintained 1 control plot. Although adult removals were generally successful, in a few instances adult densities recovered to near normal levels before a subsequent removal. To reduce any bias resulting from these instances, we classified adult fox squirrels in 2 density classes--high, >0.50/ha and low, <0.50/ha--and calculated recruitment for each density class (Table 2).

Table 2. Recruitment (number of unmarked fox squirrels/ha) on grids with high and low densities of adult males and females.

| | Recruitment | | | | | | | |
|--------------|-------------|--------|----------|--------|-------------------|--------|-------|--------|
| | Adult | | Yearling | | Juvenile-Subadult | | Total | |
| | Male | Female | Male | Female | Male | Female | Male | Female |
| Fall | | | | | | | | |
| Males | | | | | | | | |
| High Density | 0.22 | 0.42 | 0.09 | 0.10 | 0.68 | 0.84 | 0.98 | 1.54 |
| Low Density | 0.33 | 0.18 | 0.31 | 0.19 | 0.41 | 0.07 | 1.05 | 0.64 |
| Females | | | | | | | | |
| High Density | 0.29 | 0.22 | 0.28 | 0.14 | 0.35 | 0.30 | 0.92 | 0.68 |
| Low Density | 0.23 | 0.46 | 0.03 | 0.15 | 1.03 | 1.12 | 1.29 | 1.71 |
| Spring | | | | | | | | |
| Males | | | | | | | | |
| High Density | 0.09 | 0.19 | 0.35 | 0.10 | 0.17 | 0.17 | 0.60 | 0.46 |
| Low Density | 0.18 | 0.20 | 0.21 | 0.13 | 0.16 | 0.14 | 0.55 | 0.46 |
| Females | | | | | | | | |
| High Density | 0.18 | 0.14 | 0.14 | 0.03 | 0.13 | 0.03 | 0.46 | 0.23 |
| Low Density | 0.12 | 0.23 | 0.35 | 0.20 | 0.20 | 0.24 | 0.67 | 0.67 |

Adult male and adult female recruitment rates were higher on those plots where adult males and adult females had been removed, respectively, during both spring and fall trapping periods (Table 2). During spring, yearling male and female recruitment was greatest on female removal plots. During fall, male recruitment was highest on male removal plots, whereas female recruitment appeared unrelated to adult densities. Both male and female juvenile-subadult recruitment were impacted by adult females; recruitment of young, especially females, was low where adult females were abundant (Table 2).

These results indicate that male and female adults may influence recruitment in different ways, depending on the sex and age class of potential recruits being considered. It is apparent that in unmanipulated populations, potential recruitment far exceeds actual recruitment, and that adult female fox squirrels most strongly limit recruitment, especially of young.

Responses of Prairie Chickens to Habitat Manipulation - W-66-R R.L. Westemeier,
J.E. Buhnerkempe

For 20 consecutive years we have searched for nests of prairie chickens and other grassland fauna in Jasper and Marion counties. Our intensive search in 1982 revealed 29 prairie chicken nests on 142 ha (351 acres) of sanctuary in Jasper County and 19 chicken nests on 49 ha (120 acres) of sanctuary in Marion County. Percent nest success was good in both counties, though not as high as in 1981 (MWRL 24(8):3). In Jasper County, rates of hatch, predation, and abandonment were 55.0%, 28.0%, and 17.0%, respectively, for the 29 nests. In Marion County, excluding 2 nests of unknown fate and 1 atypical nest with 1 abandoned egg, we found 10 hatches (62.5%) and 6 (37.5%) instances of predation.

The 17% rate of desertion at Bogota was the highest on record for prairie chicken nests. Of the 5 deserted nests, 3 nests contained 2, 3, and 10 apparently infertile eggs, but 2 other nests, with 14 and 8 eggs, contained well-developed embryos. Prior to the presence of pheasants in substantial numbers, nest abandonment averaged only 3% at Bogota in 1963-68 (MWRL 24(10):3). In Marion County, where there are essentially no pheasants, nest desertion by prairie chickens has been almost nil in a sample of 52 nests of known fate. Twenty-nine of the nests for Marion County were found in 1981-82; the other 23 nests date back to 1964. These comparative data for the 2 counties further implicate the pheasant as a factor in reduced productivity of prairie chickens at Bogota.

Three prairie chicken nests were parasitized by pheasants this year; at one, the eggs and chicken hen were destroyed by predation, but the other 2 parasitized nests had hatched--including the pheasant eggs. Each parasitized chicken nest contained at least 3 pheasant eggs. The 10.3% level of parasitism this year was well above the average of 3.8% for 1969-81.

Another alarming trend, evidently due to pheasant harassment, was a steady decline in hatched chicken eggs per clutch--from 11.1 in 1963-68 to 8.8 in 1981. This summer, however, hatchability rose sharply to an above-average mean of 11.6 hatched eggs per successful nest.

In the spring of 1982, the pheasant population at Bogota continued to be relatively high (MWR 25(6):2-3), so we expected the high levels of desertion and parasitism of chicken nests. However, we are unable to explain the improved level of hatchability for prairie chicken eggs that occurred despite high numbers of pheasants on the sanctuaries.

Of the 17 pheasant nests found on sanctuaries at Bogota this year, only 5 had hatched, 8 were destroyed by predators, 3 were abandoned, and the eggs from 1 nest were collected. Excluding the collected clutch, nest success for pheasants was 31.3%, compared with 44.2% nest success for 95 pheasant nests of known fate from 1969 through 1981.

Of only 6 bobwhite nests found this year, 4 had hatched, 1 was destroyed by predators, and 1 was abandoned. Of 5 mallard nests found on sanctuaries this summer, 2 had hatched, and 3 were destroyed by predators.

Ecology and Management of White-tailed Deer - W-87-R

C.M. Nixon, L.P. Hansen,
J.E. Chelsvig, P.A. Brewer

Ninety-nine total deer rumina were collected from 12 counties in central and west-central Illinois between February 1980 and May 1982 and the contents were analyzed using standard procedures. Eighty-seven foods were identified; 11 of these comprised 89% of the total volume ingested. The 11 plant foods, in order of frequency, were corn, honey locust, coralberry, soybeans, grasses, multiflora rose, winter wheat, acorns, wild crabapple, Japanese honeysuckle, and small-flowered buttercup. Multiflora rose and wild crabapple accounted for 14.2% of the total food volume, indicating the importance of successional habitats for deer. Collectively, grasses, clovers, avens, small-flowered buttercup, winter wheat, and moneywort made up about 5.0% of the total food volume. These items are available to deer even during winter, because Illinois rarely has extended periods of heavy snow cover.

Deer in central Illinois apparently are not heavily dependent on hardwood browse at any season, even winter. The most heavily browsed hardwood species are elms, occurring in 7.0% of the samples but comprising only 0.5% of the total volume. Although many studies have found elms to be of low use, undesirable, or an emergency diet, our finding that elms are important as browse in spring and summer concurs with recent findings in Missouri.

Other recent work in Missouri emphasized the need for deer to ingest a variety of forage, and our data seem to support this study. Although deer may use some plant species only in low amounts, ingestion of a mixture of species is seemingly important if deer are to meet nutritional and energy demands. The Missouri study has also shown that a wide variety of chemical and structural compositions of forage exist in early successional habitats, reaffirming the traditional management concept of retarding and diversifying succession.

Cooperative Waterfowl Research - W-88-R

F.C. Bellrose, S.P. Havera,
G.A. Perkins, H.K. Archer

The 1st sign in Illinois of the fall waterfowl migration is the arrival of small flocks of blue-winged teal, usually in late July. Bluewings leave their breeding grounds in south-central Canada and north-central U.S. and stop briefly in Illinois for food and rest. In the 1st aerial census this fall (conducted 14 September by Robert Crompton), bluewings numbered 10,900 in the Illinois River valley and 5,800 in the Mississippi River valley. On the same date in 1981, 20,500 and 10,000 bluewings were observed in the Illinois and Mississippi river valleys, respectively--approximately twice as many as were observed this year.

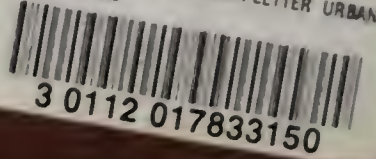
During the falls of 1978 through 1981, bluewing numbers peaked in the 1st or 2nd week of September. The average peaks for 1978-1981 were 37,000 and 15,100 birds in the Illinois and Mississippi valleys, respectively. High water levels during most of the summer of 1982 in the Illinois Valley left mudflats inundated and limited the growth of moist-soil plants which produce seeds for blue-winged teal to feed upon. Recent low river levels have exposed vast mudflats, but the lateness of the low water conditions left a growing season too short for the establishment and maturation of moist-soil plants. Consequently, the natural food conditions this fall in the Illinois River valley are bleak. In addition, the bluewing breeding population estimate, determined by the U.S. Fish and Wildlife Service (USFWS), was down 5% in 1982 from the 1981 value; the 1982 estimate was also down 23% from the 1955-81 average. Thus, fewer bluewings are available to pass through Illinois this fall.

The fall migration of green-winged teal through Illinois is somewhat later and much more protracted than that of the blue-winged teal. Greenwing numbers peaked in October or early November during the falls of 1978-81. Average fall peak numbers for 1978-81 were 16,000 birds in the Illinois Valley and 11,700 birds in the Mississippi Valley. On 14 September 1982, greenwing numbers totaled 900 in the Illinois River valley and 440 in the Mississippi River valley, substantially lower than the 6,300 and 5,800 for the Illinois and Mississippi River valleys, respectively, for the same date in 1981. The USFWS breeding-population estimate for green-winged teal was down 11% from the 1981 estimate but up 6% from the 1955-81 average.

Both species of teal have exhibited a definite preference for certain bottomland lakes and water areas in recent years. In the Illinois Valley, teal concentrate at Goose Pond (near Hennepin) and Rice Pond, as well as Pekin, Spring, Clear, Chautauqua, Chain, Big Prairie, Meredosia, Flat, and Swan lakes. In the Mississippi Valley, the largest teal concentrations are in the Dallas City to Fort Madison segment of the river and the refuges such as Cannon and Batchtown.

In general, teal numbers were quite low in the Illinois and Mississippi river valleys during the 1982 teal hunting season.

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